DOCUMENT RESUME

ED 186 440 TM 800 019

AUTHOR Kastrinos, William; Livingston, Samuel A.
TITLE The Development of a Proficiency Examination for Dental Auxiliaries.
INSTITUTION Educational Testing Service, Princeton, N.J. Center for Occupational and Professional Assessment.
SPONS AGENCY Health Resources Administration (DHEW/PHS), Hyattsville, Md.
PUB DATE 79
CONTRACT 231-77-0119
NOTE 117p.

EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS *Criterion Referenced Tests; Cutting Scores; *Dental Assistants; *Dental Hygienists; Higher Education; Multiple Choice Tests; Observation; *Occupational Tests; Performance Tests; Pretesting; Scoring; *Test Construction; Test Reliability; Work Sample Tests
IDENTIFIERS Interobserver Reliability

ABSTRACT

This report describes the development of a criterion-referenced proficiency examination for dental auxiliaries that consists of both written and performance tests in each of five areas: chairside assisting, patient education, diagnostic aids, therapeutics, and laboratory procedures. The content outlines of the tests are presented. The formation of the committees and the processes of test planning and test development are described. Checklists were developed for the observers to use in scoring the performance tests. A preliminary field trial of the test was administered to a small sample of dental auxiliaries, and revisions were made to the test and the scoring checklists. The revised tests were then administered to 115 dental assistants or dental hygienists. The development of the scoring formulas for the performance tests was a three-stage process. Inter-observer reliabilities were computed for each subtest, and score distributions were compared for auxiliaries rated adequate with those rated inadequate by the observers. Various methods were used to select recommended pass/fail cutoff scores. Conclusions of the study and recommendations for further development are presented. (Author/CTM)

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THE DEVELOPMENT OF A PROFICIENCY EXAMINATION FOR DENTAL AUXILIARIES

Final Report

Covers Period of Performance
During
September 30, 1977 - September 29, 1979

Contractor

Center for Occupational and Professional Assessment
Educational Testing Service
Princeton, New Jersey 08541

Sponsor

DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Public Health Service
Health Resources Administration
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TM800 019

EDUCATIONAL TESTING SERVICE
PRINCETON, NEW JERSEY

Table of Contents

	Page No.
Acknowledgements	i
Abstract	iii
Introduction	1
Description of the Examination	4
The written tests	4
Chairside assisting	4
Patient education	6
Diagnostic aids	6
Therapeutics	6
Laboratory procedures	7
The performance tests	7
Assisting with restorations	11
Surgical scrub and glove	11
Instructing a patient in oral hygiene	11
Taking vital signs	12
Dental radiography	13
Charting from dictation	13
Taking an alginate impression	14
Placing and removing a periodontal dressing	14
Coronal polishing	14
Polishing an amalgam restoration	15
Pouring and trimming a study cast	15
Development of the Examination	17
The Advisory Committee	17
The Working Committee	18
Development of the Performance Tests	21
Task specifications	21
Review of existing materials	22
Development of performance checklists	23
Review by consultants	26
Review by subcommittee	26
Review by the full Working Committee	27
Review by the Advisory Committee	27
Selection of pretest and pilot test sites	28
Training of observers for the pretest	29
Pretesting	31
Revision of test materials by the Working Committee	35
Training of observers for the pilot test	35

Page No.

Development of the Performance Tests (cont'd)

- Pilot testing 36
- Development of scoring formulas 39
- Final review by the Working Committee 41
- Scoring of the performance tests 41
- Inter-observer reliability of the performance tests 44
- Observers' judgments of examinee performance 49

Development of the Written Tests 51

- Content specifications 51
- Writing of test items 52
- Review by subcommittee 54
- Review by committees 55
- Pretesting and revision of the written test items 55
- Pilot testing of the written tests 56
- Reliability of the written tests 57
- Estimated reading difficulty of the written tests 60

Recommendations for Pass/Fail Cutoff Scores 61

- Cutoff scores for the performance tests 63
- Cutoff scores for the written tests 69

Recommendations and Conclusions. 76

- Eligibility requirements for examinees 76
- Separate modules of the examination 76
- Observers for the performance tests 77
- Administration of the performance tests 78
- Additional test development 79

Addenda 82

- Test site personnel 82
- ETS project staff 84
- Coordinator's manual
- Advance instructions to the examinee
- General instructions for performance test observers
- Instructions to the operator (for performance test in assisting with restorations)

List of Tables

Table		Page
1.	The Written Tests: Number of Questions on Each Topic	5
2.	Characteristics of the Performance Tests	11
3.	Chronology of the Dental Auxiliary Examination Project	16
4.	The Working Committee	19
5.	Work Groups for Development of the Performance Tests	24
6.	Pretest and Pilot Test Sites	30
7.	Number of Examinees Taking Each Performance Test During Pretesting of Examination	33
8.	Working Committee Members Attending Observer Training and Pretesting of Examination	34
9.	Summary of Professional Experience of Pilot Test Examinees	37
10.	Number of Checkpoints and Range of Scoring Weights for Performance Tests	42
11.	Distributions of Examinees' Scores on Performance Tests (average of two observers)	43
12.	Distribution of Scores on Performance Test in Charting from Dictation	45
13.	Distribution of Inter-Observer Differences on Performance Tests	46
14.	Average Inter-Observer Difference for Performance Tests at each Testing Institution	48
15.	Observers' Judgments of Examinees' Performance	50
16.	Distributions of Scores on Written Tests	58
17.	Standard Error of Measurement of the Written Tests	59
18.	Distributions of Performance Test Scores, Classified by Observer's Judgment	64

Page

Table

19. Estimated Probability That an Examinee's Performance Would be Judged Adequate. 67

20. Recommended Pass/Fail Cutoff Scores for the Performance Tests and Resulting Failure Rates for Pilot Test Examinees. 68

21. Written Test Cutoff Scores by Three Different Methods and Resulting Failure Rates for Pilot Test Examinees. 71

22. Suggested Cutoff Scores for the Written Tests (pending further investigation) 74

Acknowledgements

We would like to thank the many people who helped make this project possible. We are especially appreciative of the contributions of the following members of the Advisory Committee: Barbara A. Byrd, RDH, and Diane J. Jessop, RDH, representing the American Dental Hygienists' Association; William J. Meyers, DDS, representing the American Dental Association; Arthur Lenzini, DDS, representing the National Board of Dental Examiners; Dr. Joseph Kadish, of the Division of Associated Health Professions, U.S. Department of Health, Education, and Welfare; and George F. Follansbee, representing consumers of dental services.

The actual development of the examination was primarily the work of the Working Committee: Carolyn Hawkins, RDH; Evelyn Hobbs, RDH; Kathy Jespersen, CDA; Suzanne Jones, CDA; Sara Chinn-Karabasz, RDH; Karl W. Lange, DMD; Clara Miera, CDA; Phyllis Shelton, CDA; Cathy P. Turbyne, RDH; and Rhame Wood, DDS. It is difficult to convey our indebtedness to the members of this committee. Their spirit of cooperation, their enthusiasm, and their dedication to the development of the examination exceeded what anyone might reasonably expect. Time and again they responded to our requests for help far beyond the scope of their original commitment.

We are indebted to the pretest and pilot test coordinators, observers, and operators (whose names are listed as an addendum to this report), not only for giving the examination its first real tryouts, but also for their many helpful suggestions during the observer training workshops. We owe our special thanks to Sharon Moore, CDA, who was host to the first workshop and helped coordinate the second, and to James L. Monahan, DDS, who was host to the second workshop.

We are also indebted to the other ETS staff members who worked with us on this project; their names and the nature of their contributions are listed in an addendum to this report.

Finally, we would like to acknowledge the significant contributions of our project officer, Lois K. Kryger, of the Division of Dentistry, U.S. Department of Health, Education, and Welfare. Her knowledge of the field, patience, advice, encouragement, and careful monitoring facilitated all aspects of this project.

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ABSTRACT

This report describes the development of a criterion-referenced Proficiency Examination for dental auxiliaries. It consists of written multiple-choice tests and performance (practical) tests in each of five areas: chairside assisting, patient education, diagnostic aids, therapeutics, and laboratory procedures. The written tests emphasize knowledge of correct procedures needed on the job. The performance tests consist of selected tasks to be performed under standardized conditions -- some on real patients, others on patient-actors or dental manikins. They include evaluations of both process (procedure) and product. Examinee performance is recorded by observers using checklists. These performance checklists are highly specific, to minimize differences between observers. Scoring formulas, the same for all examinees, translate the recorded observations into numerical scores.

The tests were developed by a ten-person Working Committee of dentists, dental assistants, and dental hygienists, working closing with ETS staff, under the guidance of an Advisory Committee of persons nominated by associations in the dental professions. The project included two tryout administrations of the examination: a small-scale "pretest" (24 examinees) and a larger-scale "pilot test" (115 examinees). Each was preceded by a two-day training workshop for the performance test observers. The tests were revised extensively on the basis of the pretest; minor revisions were made after the pilot test. Score distributions and reliability statistics were computed from the pilot test data.

The report concludes with recommendations concerning the use of the examination.

INTRODUCTION

This report describes the development of a proficiency examination for dental auxiliaries -- i.e., dental assistants and dental hygienists. A proficiency examination is an examination that is intended to reflect a person's ability to do a job, (or a group of jobs, or a portion of a job). A proficiency examination is not the same thing as an academic equivalency examination: "Occupational proficiency examinations are intended to determine whether the individual meets job knowledge requirements, which are not necessarily the same as the knowledge required to obtain a degree in the field. These examinations may also include a determination of whether the individual possesses the necessary skills to perform adequately."* A proficiency examination tests knowledge and skills directly involved in the performance of the job and tests them in the context of practical applications on the job. In the context of the health professions, a proficiency examination has been defined as "a criterion-referenced appraisal of the individual's possession of the performance knowledge and skill competencies required to execute the role responsibilities of the given practitioner generic position."** A proficiency examination is criterion-referenced in the sense that it yields a score or set of scores that are to be interpreted in terms of an absolute standard of proficiency, rather than in terms of the examinee's relative standing in a group.

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* M. Y. Pennell and D. B. Hoover, "Policies for the development of credentraling mechanisms for health personnel," Operation MEDIHC, February, 1972, Vol. 2, no. 3. (New York: National Health Council)

** Margaret A. Wilson, "An introduction to the proficiency examination," American Journal of Occupational Therapy, March, 1977, Vol. 31, no. 3, pp. 162-168.

The Proficiency Examination for Dental Auxiliaries consists of both written tests and performance (practical) tests in each of five competency areas: chairside assisting, laboratory procedures, diagnostic aids, patient education, and therapeutics. The examination was designed to be a complete examination covering the range of functions normally performed by dental auxiliaries. However, to allow greater flexibility in its use, the examination is in "modular" format. That is, the written test and the performance test in each competency area constitute a separate "module" that can be administered separately from the other tests. The written and performance components of each module were designed to be used together. The written component alone does not test the important physical skills and communication skills necessary to perform the tasks in the competency area. The performance component alone tests too small a sample of skills and knowledge. But together, the written and performance components provide an effective test of the knowledge and skills involved in performing the tasks in each competency area.

The Dental Auxiliary Examination Project began with a request for proposals, issued by the Department of Health, Education, and Welfare, Bureau of Health Resources Development, Division of Dentistry (RFP No. HRA 231-7E-0579). The purpose of the project, as stated in the request for proposals, was "to develop a proficiency examination to appraise the entry-level knowledge and skill competencies of dental auxiliaries (dental hygienists and dental assistants) for use in the credentialing process." The legislative authorization of the project was stated as follows:

> In recent years the Federal Government has assumed a significant role in the development of proficiency testing mechanisms through two specific authorities. The Health Training Improvement Act of

1970 (P.L. 91-519) authorized contracts for "developing, demonstrating, or evaluating techniques for appropriate recognition (including equivalency and proficiency testing mechanisms) of previously acquired training or experience. . ."; and the Social Security Amendments of 1972 (P.L. 92-603, Sec. 1123), which authorize the development of proficiency examinations until 1977 for personnel who do not meet formal educational, professional membership requirements, or other specific criteria established to determine qualifications of health care personnel for reimbursement of services under Titles XVIII and XIX of the Act. The Division of Associated Health Professions (HRA) and the Bureau of Quality Assurance (HSA) have been carrying out the development of the examinations as authorized, and through a memorandum of agreement, have coordinated their activities to optimize their effort and avoid duplication. It is intended that the instruments will be utilized by the professions to satisfy their credentialing program, by State credentialing agencies, merit systems, Civil Service agencies, and other entities for purposes of assessing practitioner competency. Further, it is expected that proficiency tests will be based upon National performance standards of competency for credentialing all health care personnel. This long-range goal is aimed at providing opportunities for geographic and career mobility for health personnel; establish a means of recognizing previously acquired training or experience; and providing access to health care by competent personnel.

A contract to develop the examination was awarded to Educational Testing Service (ETS) in October of 1977. ETS had previously worked with professional organizations to develop credentialing examinations in several other health professions, including podiatry, obstetrics and gynecology, pharmacy, nursing, respiratory therapy, and radiologic technology. ETS had also developed a series of college equivalency examinations in dental auxiliary education.

Description of the Examination

The written tests

The examination includes a written multiple-choice test for each of the five competency areas. Although these tests were designed to be administered at a single 3 1/2-hour session, they are separately timed and separately scored, and are not in any way dependent on each other. The tests are made up of four-choice questions. Three of the written tests (diagnostic aids, patient education, and dental therapeutics) exist in two versions: a shorter version intended for dental assistants and a longer version intended for dental hygienists. The longer version includes all of the questions in the shorter version, plus several additional questions. The reason for the existence of two versions of the written tests in these areas is that each of the written tests covers several tasks, and some of the tasks regularly performed by dental hygienists are not performed by dental assistants (in most states). The existence of the two versions does not imply a different standard of proficiency for dental assistants than for dental hygienists. On the contrary, the development of the Proficiency Examination was based on the premise that the level of proficiency required of a person who performs a task should be the same regardless of whether that person is a dental assistant or a dental hygienist.

The content of the written tests concentrates heavily on knowledge of correct procedures. The emphasis is on practical knowledge -- knowing what to do in a given situation on the job. The specific content of the written tests is summarized in the following paragraphs and in Table 1.

Chairside assisting. This test includes questions on preparation and maintenance of the operating area (including disinfection and aspiration),

Table 1. The written tests: Number of questions on each topic.

	Assistants' version	Hygienists' version
Chairside assisting		
Preparation and maintenance of the operating area (disinfection, preparation of patient)	14	
Efficient utilization of dental auxiliaries (aspiration, clearing the field, delivering and retrieving instruments)	15	
Restorative materials	16	
Impression materials	12	
Medical emergencies	7	
Total	64	
Patient education		
Oral hygiene needs assessment	13	17
Oral hygiene techniques (including dietary analysis and counseling)	12	20
Evaluation of patients' progress	1	3
Total	26	40
Diagnostic aids		
Vital signs (blood pressure, pulse rate)	10	10
Radiology	24	26
Medical and dental history	7	8
Preliminary oral examination (including periodontal probing and charting)	3	9
Taking diagnostic impressions	5	7
Total	49	60
Therapeutics		
Application of topical agents	4	4
Polishing teeth and restorations	3	13
Placement and removal of tissue dressings	6	6
Suture removal	2	2
Removal of calculus deposits (including root planing) and marginal overhang	0	11
Total	15	36
Laboratory procedures		
Preparing study casts	6	
Fabricating acrylic temporary crown restorations	2	
Fabricating custom acrylic impression trays	6	
Cleaning and polishing removable appliances	4	
Sterilization and disinfection of instruments	10	
Total	28	

delivering and retrieving instruments, preparing and delivering restorative materials, preparing and delivering impression materials, and dealing with medical emergencies. This test is the same for assistants as for hygienists. It consists of 64 questions, and the time limit is 60 minutes.

Patient education. This test exists in two versions, one for dental assistants and one for dental hygienists. Both versions include questions on oral hygiene needs assessment, oral hygiene techniques, dietary analysis, and evaluation of the patient's progress. The dental assistants' version of the test consists of 26 questions and has a time limit of 25 minutes; the dental hygienists' version consists of 40 questions and has a time limit of 35 minutes.

Diagnostic aids. This test also exists in two versions. The dental assistants' version includes questions on taking a medical and dental history, taking vital signs, taking diagnostic impressions, and dental radiography. It consists of 49 questions and has a time limit of 45 minutes. The dental hygienists' version includes questions on the same topics as the assistants' version and also on performing a preliminary oral examination (including periodontal probing and charting). It consists of 60 questions and has a time limit of 55 minutes.

Therapeutics. This test also exists in two versions. The dental assistants' version includes questions on the application of topical agents, polishing restorations, removal of marginal overhang, placement and removal of tissue dressings, and suture removal. It consists of fifteen questions and has a time limit of fifteen minutes. The dental hygienists' version includes questions on the same topics as the assistants' version and also on polishing teeth and the removal of calculus deposits (including root planing). It consists of 36 questions and has a time limit of 35 minutes.

Laboratory procedures. This test includes questions on preparing study casts, making acrylic temporary crown restorations, making custom acrylic trays, cleaning and polishing removable appliances, and disinfecting and sterilizing instruments. The test is the same for assistants as for hygienists. It consists of 28 questions and has a time limit of 25 minutes.

The performance tests

A performance test is one in which the examinee (the person taking the test) actually performs the tasks for which he/she is being tested. The critical problem in most performance tests is subjectivity -- the fact that an examinee's score may depend on the individual standards of the person who administers and scores the test. In any test that calls for the examinee to demonstrate a procedure, the examinee's performance must be translated into a number or some other form that can serve as the basis for a decision. The scoring process inevitably involves some degree of human judgment. The judgmental part of the scoring process cannot be removed, but it can be standardized, by the use of a technique called analytic scoring. This technique requires the test developers to analyze each task into a series of highly specific actions. Each action can then be observed and recorded as being done or not done, with little chance of disagreement between observers. These specific actions are listed on a performance checklist, which the observer uses to record the examinee's performance. The information on the checklist is converted to a numerical score by means of a scoring formula that is applied uniformly to all examinees.

Performance tests can test either process or product--or both. Obviously, if the task yields an observable product, it makes sense to evaluate the product, but it may be important to evaluate the process also. An incorrect

technique may produce an inadequate product only part of the time, or it may produce an adequate product but present an unnecessary danger to the patient. If the test evaluates only the product, it will award full credit to an examinee who uses such an incorrect technique but happens to produce an adequate result on the occasion of the test. For this reason, most of the performance tests in the Proficiency Examination for Dental Auxiliaries include evaluations of both process and product.

One of the more difficult questions of performance testing is the question of which aspects of the task to standardize. This question applies to equipment, materials, procedures, and the behavior of other persons the auxiliary must work with. In general, the performance tests in this examination do not specify a particular operatory layout. They do not require the standardization of large equipment (e.g., x-ray units). They do require a particular assortment of small equipment (e.g., hand instruments) and dental materials, specified by type but not by manufacturer. Some aspects of the procedures are standardized (e.g., the number of films in the x-ray series); others are not (e.g., the charting system in charting from dictation). Where the auxiliary must work closely with another person who participates actively in the task (e.g., the dentist), that person's behavior has been standardized.

The examinee is told in advance which specific tasks will be tested in the performance tests and whether each task will be performed on a manikin or on an actual patient. If there is more than one acceptable procedure for doing a task, but a particular procedure is specified for the test, the examinee is told in advance which procedure is to be used. Some of the performance tests have time limits, and the examinee is told the time limits in advance.

The specific tasks included on the performance tests are these:

Chairside Assisting

Assisting with restorations:

completing tray setups

preparing the unit and chair

assisting with the preliminary examination of the patient

assisting with the administration of a local anesthetic

assisting with the placement and removal of a rubber dam

assisting with cavity preparation

assisting with amalgam and composite restorations

Surgical scrub and glove

Patient Education

Instructing the patient in oral hygiene practices

Diagnostic Aids

Taking vital signs: pulse rate, respiration rate, blood pressure

Dental radiography

Charting from dictation

Taking an alginate impression

Dental Therapeutics

Placing and removing a periodontal dressing

Coronal polishing

Polishing an amalgam restoration

Laboratory Procedures

Pouring and trimming a study cast

Some of the important characteristics of these tests are described below and summarized in Table 2.

Table 2. Characteristics of the Performance Tests.

Test	Process/product	Type of patient	Examinee time (minutes)	Special features
Chairside Assisting:				
Assisting with restorations	process	manikin	60 (approx.)	Requires operator. Includes tray set-ups, local anesthetic, rubber dam.
Surgical scrub and glove	process	none	10 (approx.)	
Patient Education:				
Instructing a patient in oral hygiene	process	actor	20	Patients' oral condition presented via chart and photos.
Diagnostic Aids:				
Taking vital signs	both	any person	15 (approx.)	
Dental radiography	both	actual patient	30 for exposure, plus mounting	Examinee does not process films. May use either bisecting or paralleling technique.
Charting from dictation	(see "special features")	fictitious	15 (approx.)	Evaluation is indirect; examinee uses own chart to answer questions.
Taking an alginate impression	both	any person	25 (approx.)	Two attempts permitted. Includes wax bite.
Therapeutics:				
Placing and removing a periodontal dressing	both	any person	15 to place 5 to remove	
Coronal polishing	both	actual patient	20	Examinee polishes two quadrants. Patient must have any calculus removed prior to test.
Polishing an amalgam restoration	both	manikin	10	Must maintain occlusal anatomy.
Laboratory Procedures:				
Pouring and trimming a study cast	product	person or manikin	30 (approx.)	Single pour in dental stone.

Assisting with restorations. This test is the longest and most complex of the performance tests. It includes several tasks and is the only one of the performance tests that requires a skilled person to take the role of the dentist. This person's behavior is standardized for the test, by requiring him/her to work right-handed from a sitting position, receiving instruments within a specified zone of transfer. The procedure for the test, including the sequence of instrument transfers, is standardized and is directed by one of the observers. The "patient' is a manikin. Because the product of a restoration procedure is the responsibility of the dentist, rather than the auxiliary, the test in assisting with restorations is an evaluation of process only. It requires approximately an hour of testing time (not including set-up and clean-up).

Surgical scrub and glove. This test is a brief, straightforward test, requiring no patient and no special instructions. The test measures process, rather than product. It requires less than ten minutes.

Instructing a patient in oral hygiene. This test makes use of a testing technique called the "programmed patient." The patient is a "patient-actor," not necessarily a professional actor, but a person who has been specially trained for the role of patient in this examination. The patient-actor is "programmed" to respond in certain specified ways to the examinee's questions and instructions. This "program" provides a way to standardize the patient's behavior. Part of the patient's "program" involves the actual physical condition of the patient's mouth, which is presented to the examinee in the form of dental charts and intraoral photographs. (The examinee is instructed not to inspect the patient-actor's mouth.) Pencils, paper, toothbrushes, dental floss, a hand mirror, and a dental manikin are provided. The examinee

is responsible for deciding what to teach the patient and how to teach it. The only specification of goals for the patient education session is to "improve the patient's oral hygiene practices." Since there is no observable product, the test is an evaluation of process only. The examinee is allowed twenty minutes to examine the intraoral photos and other materials providing information about the patient (dental chart, dental history, medical history) and to conduct the patient education session.

Taking vital signs. This test is done on a person who need not be an actual dental patient. The examinee must take this person's pulse, record the person's respiration rate, and take the person's blood pressure, using a stethoscope and blood pressure cuff. The accuracy of the examinee's measurements is determined by comparing them with measurements taken by the observers immediately before and after the examinee takes them. Each of the examinee's measurements is required to be within a specified tolerance of the nearer of the two measurements taken by the observers or of the average of the two observers' measurements. The test emphasizes product--the accuracy of the measurements--but evaluates process also. It requires approximately fifteen minutes.

Dental radiography. This test requires the examinee to take an actual x-ray film series on an actual dental patient. The series consists of fourteen periapical films and bite wings sufficient to cover the area. The examinee may use either bisecting or paralleling technique and may use any type of film holder. The examinee does not process the films. Instead, the observer or another person familiar with the equipment at the test site processes the films. The exposures are made with double film packs. One set of films is returned to the examinee for mounting. The other set is sent to the patient's dentist. This test emphasizes product but includes an evaluation of process also. The completed x-ray films are evaluated as a group, rather than individually; the examinee receives credit for each specified anatomical feature demonstrated adequately at least once in the x-ray series.* The observers are provided with sample films showing examples of acceptable and unacceptable demonstration of each type of feature. These films have been selected to represent borderline cases, so as to be of maximum benefit as an aid in scoring. Because the examinee may be taking the test on an unfamiliar x-ray unit, the films are not evaluated for density. The examinee must complete the exposures in 30 minutes. There is no time limit for mounting the films.

Charting from dictation. This test is different from the other performance tests in that the examinee's performance is not directly observed. Therefore, this test can be administered to a group of examinees at the same time. The only limit on the size of the group is that all the examinees must

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*This portion of the test is adapted with permission from Arthur H. Wuehrmann, DMD: "Evaluation criteria for intraoral radiographic film quality," Journal of the American Dental Association, August 1974, Vol. 89, pp. 345-352.

be able to hear the dictation. The test does not require the examinee to use a particular system of charting, and the examinee's chart is not evaluated. Instead, the examinee must answer a series of questions on the basis of his/her completed chart. The dictation is presented in the form of a tape recording. Between the two parts of the test (charting from the tape recording and interpreting the chart) the examinees take other tests. The dictation takes approximately ten minutes; the questions can be answered in five minutes.

Taking an alginate impression. This test is done on a person who need not be an actual dental patient. The examinee must take alginate impressions of both arches and a wax bite. The examinee may use either regular or fast-set alginate material (both are provided). The evaluation includes both process and product. There is no time limit; the test requires approximately 25 minutes.

Placing and removing a periodontal dressing. This test is done on a person who does not have an actual gingival wound in the area where the dressing is to be placed. The observer uses a color transfer applicator to make a "wound" on the "patient's" gingiva. The test includes an evaluation of both process and product. The examinee is allowed fifteen minutes to mix, place, and trim the dressing and five minutes to remove it.

Coronal polishing. This test is done on an actual dental patient. The patient must have all calculus removed before the test. The examinee is not expected to remove calculus, but is expected to remove extrinsic stain and plaque. The test calls for the examinee to polish two diagonally opposed quadrants. The examinee may not use disclosing solution as an aid, although the observers use it in checking for the presence of plaque after

polishing -- after checking for evidence of laceration or abrasion of the patient's gingival tissue.* The test includes an evaluation of both process and product. The time limit for polishing both quadrants is twenty minutes.

Polishing an amalgam restoration. This test is done on a dental manikin having a large unpolished restoration. The examinee is to polish the restoration so as to maintain the occlusal anatomy carved into the restoration. The examinee is not expected to correct any irregularities in the unpolished restoration. The observers are provided with photographs of adequately and inadequately polished restorations to serve as a guide in evaluating the polished restoration. The test includes an evaluation of both process and product. The time limit is ten minutes.

Pouring and trimming a study cast. This test does not require a patient, but does require a completed alginate impression. (This can be the impression taken by the examinee as part of a performance test, or any other impression that is available, including an impression taken on a dental manikin.) The examinee must pour the cast in dental stone, using a single-pour technique. Before the cast hardens, the examinee is to perform a "bench trim," using a lab knife to cut away excess material. After the cast hardens, the examinee must complete the trimming of the cast, using a model trimmer. This test is an evaluation of product only; the observer examines the completed cast, but does not observe the procedure. There is no time limit; the test requires approximately 30 minutes, not including the time spent waiting for the cast to harden (during which the examinee can take other performance tests).

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* Disclosing solution makes this evidence difficult to see. In addition, the use of a disclosing agent before polishing would enable the examinee to get a perfect score on the test without polishing all surfaces of all teeth in the assigned quadrants, by polishing only those surfaces showing plaque.

Table 3. Chronology of the Dental Auxiliary Examination Project

August 1977	Government Issues Request for Proposals
October 1977	Government Contracts with ETS to Develop Examination
January 1978	First Meeting of Advisory Committee
February 1978	First Meeting of Working Committee; Selection of Subcommittees; Written Test Content and Performance Test Tasks Specified
March-July 1978	Writing of Questions; Review and Editing by ETS Staff
	Construction of Performance Checklists by Work Groups
August 1978	Meeting of Written Test Subcommittee
	Meeting of Performance Test Subcommittee
November 1978	Second Meeting of Working Committee
December 1978	Second Meeting of Advisory Committee
January 1979	First Observer Training Workshop
February-March 1979	Pretesting of Examination
March 1979	Third Meeting of Working Committee
April 1979	Second Observer Training Workshop
May-July 1979	Pilot Testing of Examination
August 1979	Fourth Meeting of Working Committee
August-September 1979	Writing of Final Report
September 1979	Third Meeting of Advisory Committee
October-November 1979	Revision of Final Report

Development of the Examination

The Proficiency Examination was developed in a series of steps over a period of nearly two years. Table 3 presents a chronology of the project.

The Advisory Committee

The original request for proposals for the examination project required the contractor (ETS) to "Establish an Advisory Committee . . . to provide advice and to function as a sounding board to project staff." The Advisory Committee was to consist of representatives of several specified organizations in the dental health professions, plus one member representing consumers of dental services. The professional organizations nominating members to the Advisory Committee were the following:

American Dental Association

American Association of Dental Examiners

National Board of Dental Examiners

American Dental Assistants' Association

Certifying Board of the American Dental Assistants' Association

American Dental Hygienists' Association.

The Advisory Committee met three times. The committee's first meeting was held at the beginning of the project. At that meeting the committee made suggestions concerning the content of the examination, suggested persons in the dental health professions to do the actual test development work, and suggested institutions that might serve as test sites for tryouts of the examination. Between the Advisory Committee's first and second meetings, the American Dental Assistants' Association and the Certifying Board of the American Dental Assistants' Association withdrew their representatives

from the Advisory Committee. Also, the representative of the American Dental Hygienists' Association left her position with the Association and was replaced as the Association's representative, but continued as a member of the Advisory Committee. The Advisory Committee's second meeting was held shortly before the first tryout of the examination. At that meeting the committee reviewed the examination, suggesting some revisions, and recommended additional test sites for the second tryout of the examination. The Advisory Committee's third meeting was held at the conclusion of the project. At that meeting the committee reviewed an early draft of this report and made recommendations for use of the examination.

The Working Committee

The actual development of the Proficiency Examination was done by a Working Committee of ten persons in the dental health professions, working with ETS staff. Table 4 lists the members of the Working Committee, their occupational specialties, their places of residence, and the dates and places of the meetings. For the initial phases of the project the Working Committee was divided into a Written Test Subcommittee and a Performance Test Subcommittee, each consisting of one dental practitioner, one dental assisting practitioner, one dental assisting instructor, one dental hygiene practitioner, and one dental hygiene instructor. However, the full Working Committee reviewed both the written tests and the performance tests. Therefore, the entire examination must be considered to be the product of the full Working Committee. The members of the Working Committee were selected from lists of names provided by the members of the Advisory Committee and by the professional associations. In selecting persons for the Working Committee, ETS attempted to make sure that all geographic regions of the country were represented.

Table 4. The Working Committee

Members:	Written Test Subcommittee	Performance Test Subcommittee
Dental Assisting Practitioner	Kathy Jesperson, CDA Rock Valley, Iowa	Phyllis J. Shelton, CDA Ann Arbor, Michigan
Dental Assisting Educator	Suzanne C. Jones, CDA Chapel Hill, North Carolina	Clara O. Miera, CDA Albuquerque, New Mexico
Dental Hygiene Practitioner	Carolyn B. Hawkins, RDH Newport News, Virginia	Cathy P. Turbyne, RDH Skowhegan, Maine
Dental Hygiene Educator	Sara Chinn-Karabasz, RDH Boston, Massachusetts	Evelyn R. Hobbs, RDH Seattle, Washington
Dental Practitioner	Karl W. Lange, DMD Lexington, Kentucky	Rhame Wood, DDS Bartlesville, Oklahoma

Meetings: February 10-12, 1978; Princeton, New Jersey

August 18-20, 1978; Alexandria, Virginia (Written test subcommittee)

August 26-27, 1978; Albuquerque, New Mexico (Performance test subcommittee)

November 18-19, 1978; Denver, Colorado

March 24-25, 1979; New Orleans, Louisiana

August 17-19, 1979; Boston, Massachusetts

The full Working Committee met four times, and each subcommittee met separately once. At the committee's first meeting the members divided into subcommittees and drew up specifications for the written tests and the performance tests. The next meetings were subcommittee meetings to review questions for the written tests and early drafts of the printed materials for the performance tests. The second meeting of the full committee was devoted to a review of the written tests and the performance tests in preparation for the first tryout (the "pretest") of the examination. The third meeting was devoted to a review and revision of the tests on the basis of information gained from the pretest. The fourth meeting included a final review and revision of the examination. It also included a discussion of the issues of pass/fail cutoff scores and eligibility requirements, concluding with the committee's suggestions concerning these and other issues in the use of the examination.

The test specifications for the Proficiency Examination were determined by the Working Committee, working from suggestions made by the Advisory Committee. The specifications were based on the task analysis document, "Competencies and Structural Elements Within the Classification of Dental Auxiliary Functions", which was provided by the Government.* Both the Advisory Committee and the Working Committee endorsed the premise that, although dental

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* This document is a product of the Career Options Curriculum in Dentistry Project (Contract No. 1-DH-34085, American Dental Hygienists' Association), whereby competency areas and structural elements of dental auxiliary functions were delineated by panels of experts who represented dental assisting, dental hygiene and dentistry in four geographic regions. An additional panel of experts, represented by dental assistant and dental hygienist education and practice, was subsequently asked to rate and rank the relative importance of each competency area and structural element according to specific criteria. This exercise resulted in producing the task analysis document that was used as the basis for the development of the Proficiency Examination.

assistants and dental hygienists do not all perform all of the tasks to be included in the examination, the level of proficiency required of a person who performs a task should be the same, regardless of whether the person is a dental assistant or a dental hygienist.

Development of the performance tests

Task specifications. The Advisory Committee met on January 7 and 8, 1978 in Princeton, New Jersey to begin the project. They reviewed the task analysis document and used it in making their suggestions for the content of the examination. The committee's criterion for recommending tasks for the performance tests was that any task to be included in the performance tests should involve an important skill that cannot be tested adequately in a written multiple-choice test. Most of these skills involved the physical manipulation of dental instruments and materials, although some were communications skills.

The Working Committee met on February 10, 11, and 12, 1978 in Princeton, New Jersey. At that meeting, the committee members divided into two subcommittees. Working from the Advisory Committee's suggestions and the task analysis document, the Performance Test Subcommittee developed specifications in the form of a list of tasks, including suggestions for the type of "patient" on which the examinee would perform each task: an actual patient, a manikin, or a "patient-actor" (i.e., a real person who is not an actual dental patient but has been trained to take that role in the examination). In general, the subcommittee's criterion for recommending one or another type of patient was to use a manikin for any tasks that could be tested adequately on a manikin and to use actual patients only if the examinee's skills could not be tested

adequately any other way. These specifications were not intended to be absolutely binding, but to serve as a guide for the subcommittee members who were to develop the performance tests in each competency area.

One task that is conspicuous by its absence from the performance tests is the removal of calculus deposits. The Performance Test Subcommittee spent considerable time discussing the problems involved in testing this skill and the amount of examinee time that such a test would require. They finally decided not to include this task in the performance portion of the Proficiency Examination, but to recommend that the test developed as part of the American Dental Hygienists' Association's Clinical Evaluation Study be used to test this skill.

Review of existing materials. As a preliminary step in constructing the performance tests, ETS staff members reviewed materials produced by other projects in the testing or training of dental auxiliaries. These materials included the examination forms and booklets from the American Dental Hygienists' Association's Clinical Evaluation Study (DHEW Contract No. 1-DH-44099), the Chairside Assisting Skill Evaluation (DHEW Contract No. 231-76-0031), and instructional materials from Project ACORDE (DHEW Contract No. 231-75-0407).

Two of the tasks in the ADHA Clinical Evaluation Study are included in the performance tests of the Proficiency Examination: dental radiography and coronal polishing. However, the members of the Performance Test Subcommittee preferred an approach to the measurement of these skills that included an evaluation of process as well as product. On the other hand, they decided to rely on the ADHA Clinical Evaluation Study for a performance test in calculus removal, rather than to develop a performance test for that task.

The Chairside Assisting Skill Evaluation (CASE) materials include two large collections of performance checklists, one "designed for use by students and faculty in the institutional (campus facility) setting," and the other "designed for use during the student's extramural clinical experience assignment." The CASE materials include checklists for a great many tasks. Some of these tasks are included in the Proficiency Examination, in the performance test in assisting with restorations. The influence of the CASE materials can be seen in portions of the performance checklist for this test.

The Project ACORDE materials are instructional materials, not evaluation materials. However, they contain detailed step-by-step descriptions of the proper procedure for performing several important tasks done by dental auxiliaries. The Performance Test Subcommittee members found them quite helpful in developing the performance checklists.

Development of performance checklists. The initial development of the performance tests was accomplished by small work groups. Each work group consisted of two Performance Test Subcommittee members and two ETS staff members (and, in one case, another Working Committee member who was not on the Performance Test Subcommittee). Table 5 shows the committee members serving on each work group and the dates and locations of the work sessions.

The work sessions were structured in an informal interview format, with an ETS staff member serving as interviewer. The ETS staff member led the committee members in talking through the task to be tested, step by step, using questions such as the following:

> "What does the auxiliary do next?"
>
> "What kind of mistake might the auxiliary make in doing this step?"

Table 5. Work Groups for Development of the Performance Tests.

Test Modules	Work Group Members	Work Sessions
Chairside assisting, Laboratory procedures	C. Miera P. Shelton	March 7-8, 1978 Ann Arbor, Michigan April 10-11, 1978 Ann Arbor, Michigan
Diagnostic aids Patient education	E. Hobbs C. Turbyne	March 17-18, 1978 Chicago, Illinois May 31-June 1, 1978 Seattle, Washington
Dental therapeutics	S. Chinn-Karabasz C. Miera C. Turbyne	May 21-23, 1978 Boston, Massachusetts

"How can a person observe whether the auxiliary has done this step right or wrong?"

In this way, the work group would identify "checkpoints": specific observable actions to be done in a specified way by the examinee. Ideally, each checkpoint was to correspond to one possible error (made or avoided) by the examinee. After identifying the checkpoints to be observed, the work group members would decide what equipment and materials to specify, and what instructions to give the examinee and the observer.

After each work session, the ETS staff members used their notes from the session to draft a performance checklist for each task or group of tasks. The performance checklist consisted of concise statements of the checkpoints for the task, with spaces for the observer to check "yes" or "no" for each checkpoint. The checklists also contained instructions to the observer for directing the procedure. After drafting the performance checklists and other test materials (equipment lists, additional instructions for observers, examinees, instructions, etc.), the ETS staff sent the test materials to the members of the work group, who indicated the necessary corrections by phone or mail. The ETS staff members then sent corrected first drafts to all five members of the Performance Test Subcommittee for review and comment.

In constructing the performance test in dental radiography, one of the work group members suggested basing the evaluation of the finished radiographs on a previously published evaluation form.* ETS received permission from the author to adapt this evaluation form for use in the Proficiency Examination.

* Arthur H. Wuehrmann, DMD, op. cit.

In the course of developing the performance tests, the work groups suggested several changes in the task specifications. In each case, the other members of the Performance Test Subcommittee concurred in the changes. Many of the changes involved the deletion of tasks that presented practical difficulties or required amounts of testing time that, in the subcommittee members' opinion, outweighed the desirability of including these tasks in the hands-on performance portion of the examination.

Review by consultants. At the first meetings of the Advisory Committee and the Working Committee, committee members suggested that ETS contact the dental instructor who had served as evaluation specialist for the American Dental Hygienists' Association's Clinical Evaluation Study (DHEW Contract No. 1-DH-44099).* This instructor in turn recommended that ETS consult one of his colleagues, also a dental instructor and an expert in dental auxiliary utilization.** Both these dental instructors served as consultants, to review the performance tests from the dental instructor's point of view. Their role in the project was purely advisory; all decisions involving the content and format of the performance tests were made by the members of the Working Committee.

Review by subcommittee. The Performance Test Subcommittee met in Albuquerque, New Mexico on August 26 and 27, 1978 to review the performance tests. Approximately a week before the meeting, each subcommittee member had received in the mail a copy of the performance checklists and other printed materials (observer's instructions, patient-actor's instructions, etc.). With these materials was a letter asking the subcommittee member to review the

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* John Eisner, DDS, New Jersey Dental School.

** Richard Montgomery, DDS, New Jersey Dental School.

materials with the following points in mind:

1. Does anything need to be added to the checklists or instructions?

2. Is there anything in the checklists or instructions that should be taken out?

3. Is there anything in the checklists or instructions that needs to be rewritten (e.g., anything that is not completely correct or not clear to the reader)?

4. Are there any checkpoints or groups of checkpoints that are not essential and could be deleted (to save time or to lighten the load on the observer)?

5. Are there any checkpoints that are so important that no examinee should be permitted to miss one and still pass the test?

6. If the test takes too long to administer, what can be taken out?

The subcommittee reviewed the materials and made several minor changes.

Review by the full Working Committee. The full Working Committee met in Denver, Colorado on November 18 and 19, 1978 to review both the written tests and the performance tests. Before the meeting, each member of the committee had received in the mail a copy of the performance test materials, with a letter similar to the one sent to the Performance Test Subcommittee. The committee reviewed the performance tests and made several specific changes, including the deletion of one task (preparation of an impression material).

Review by the Advisory Committee. The Advisory Committee met in Alexandria, Virginia on December 1 and 2, 1978. The primary purpose of the Advisory Committee meeting was to enable the committee to review and comment on the examination. Two members of the Working Committee, both dental assistants, attended the meeting, to help answer the Advisory Committee's questions and to make sure the Advisory Committee's suggestions were transmitted accurately to the Working Committee. The Advisory Committee offered several specific suggestions for the performance tests. ETS relayed these

suggestions to the members of the Working Committee most directly involved, and, with their approval, most of these suggestions were incorporated into the examination.

Selection of pretest and pilot test sites. The project included two trial administrations of the examinations. The first, called the pretest, was to identify any unforeseen difficulties in administering the examination and to provide data for use in revising the examination. The second, called the pilot test, was for the purpose of collecting data on a nationwide sample of examinees. The test sites were all colleges with programs in dental assisting or dental hygiene -- in most cases, both. They were suggested by members of the Advisory Committee and the Working Committee and were selected on the basis of their facilities, personnel, and willingness to participate. The pilot test sites were also selected for geographic distribution.

The personnel necessary to administer the examination at each pretest or pilot test site included a coordinator, at least two observers, an operator, a patient-actor, and a dentist-on-site. The coordinator was responsible for organizing all testing activities, obtaining the necessary equipment and materials, and arranging for examinees and patients. The observers were responsible for observing and recording each examinee's performance in the performance tests, for preparing the operatory for each examinee, and, in those performance tests that involved a live patient, for assuring the safety of the patient. The observers for the pretest and pilot test were all instructors in dental assisting or dental hygiene. The operator was needed only for the performance test in chairside assisting, in which the operator places restorations in a manikin, using the rubber dam, while the examinee assists. The patient-actor was needed only for the performance test in

patient education. The dentist-on-site was responsible for performing a preliminary examination on each actual dental patient and was to be present during the performance tests involving an actual patient, to deal with any emergency that might arise. Some of these different functions could be performed by the same person. For example, at many test sites the coordinator served as one of the observers and the dentist-on-site served as the operator.

Five institutions served as test sites for both the pretest and pilot test. They were located in New Jersey, North Carolina, Michigan, Illinois, and Iowa. An additional seven institutions served as test sites for the pilot test. Two of these were neighboring institutions, one with a dental assisting program and one with a dental hygiene program; they combined resources to serve as a single test site. These additional test sites were located in Illinois, Texas, New Mexico, Arizona, California, and Washington. Thus, the eleven pilot test sites included twelve institutions: one in the Northeast, one in the Southeast, four in the Midwest, three in the Southwest, and three in the Far West. Table 6 lists these institutions.

Training of observers for the pretest. The observers and the operators for the pretest attended a two-day training workshop on January 20 and 21 at Des Moines Area Community College, Ankeny, Iowa. The workshop was conducted by the coordinator for that test site and an ETS staff member. The workshop consisted mainly of practice sessions, at which the observers and operators practiced administering the tests to dental assisting students who served as examinees. Interspersed with the practice sessions were debriefing sessions, at which the observers and operators discussed the problems they had encountered and made suggestions for overcoming those problems. One member of the Working Committee attended, to help the ETS staff respond to

Table 6. Pretest and Pilot Test Sites.

Pretest and Pilot Test:

Des Moines Area Community College*
Ankeny, Iowa

Guilford Technical Institute
Jamestown, North Carolina

Middlesex County College
Edison, New Jersey

Southern Illinois University
Carbondale, Illinois

University of Detroit
Detroit, Michigan

Pilot Test Only:

Cabrillo College*
Aptos, California

Edmonds Community College**
Lynwood, Washington

Loyola University
Maywood, Illinois

Maricopa Technical Community College
Phoenix, Arizona

Shoreline Community College **
North Seattle, Washington

University of New Mexico
Albuquerque, New Mexico

University of Texas
San Antonio, Texas

*Site of observer training workshop

**These two institutions combined to serve as a single test site

questions from the observers and operators and to advise ETS as to which of their suggestions could be adopted directly (e.g., adding a diagram to aid the observer) and which needed to be discussed with the Working Committee.

During pretesting (and pilot testing) of the performance tests each examinee was to be observed by two observers, working independently. The observers were not to look at each other's responses until after they had completed the checklist. For pretesting (and pilot testing) an extra line was added at the end of each performance checklist, calling for the observer's overall judgment of the examinee's performance as adequate or inadequate. The observers were cautioned that "adequate" was not to be interpreted as anything more than merely adequate; the observer's judgment was to indicate whether the examinee's performance would be acceptable for an entry-level dental auxiliary in a dental office or clinic. In addition, the observers were urged to write comments on the checklists to indicate any examinee errors or administrative problems that had not been anticipated in the performance checklists and instructions.

Pretesting. During February and March of 1979 the examination was administered at the five pretest sites. Most of the pretest examinees were students in dental assisting or dental hygiene. They were paid for their participation. The written tests were administered first, in a single half-day session. The scheduling plan for the performance tests varied from one test site to another. Some test sites tested only one examinee at a time; others trained additional observers and tested two examinees at a time. In most cases, the same examinees took all the tests, but in some cases different examinees took different performance tests. (In some cases the test site coordinators could not find examinees who had a basic knowledge of chairside

assisting and could also perform all tasks in the performance tests of the therapeutics module.) Table 7 shows the number of examinees taking each performance test during pretesting.

One day of performance testing at each pretest site was observed by a member of the Working Committee. In this way five members of the committee gained first-hand knowledge of the tests in actual use. Table 8 lists the Working Committee members who attended the observer training and the pretesting.

The pretest data for the performance tests were analyzed separately for each of the tests. The data were analyzed in two different ways; one concentrated on reliability and the other on validity. The reliability analysis involved a comparison of the two independent observations of each examinee on each checkpoint. Any checkpoint for which the agreement between observers was less than 85 percent (of the examinees) was identified for special review, to detect ambiguities of phrasing, difficulty of observation, and other possible problems. The validity analysis was based on a division of the examinees into "adequate" and "inadequate" groups on the basis of the observers' overall judgment. Any checkpoints missed by a high proportion of the examinees in the "adequate" groups were identified for special review concentrating on the importance of the checkpoint and on the possible acceptability of accomplishing the task in ways not specified in the checkpoint.

In addition to the formal data analysis, ETS staff tabulated the comments written on the checklists and recorded the additional comments furnished by coordinators, observers, and Working Committee members who observed the testing. (Two observers from the New Jersey test site traveled to ETS and spent an entire afternoon discussing their comments and suggestions with ETS

Table 7. Number of Examinees Taking Each Performance Test During Pretesting of Examination.

Assisting with restorations	21
Surgical scrub	21
Oral hygiene instruction	18
Taking of vital signs	24
Dental radiography	24
Charting from dictation	22
Alginate impression	22
Periodontal dressing	20
Coronal polishing	21
Polishing amalgam restoration	21
Study cast	21

Table 8. Working Committee Members Attending Observer Training and Pretesting of Examination.

Pretest observer training

Des Moines Area Community College - K. Jespersen

Pretesting

Des Moines Area Community College - K. Jespersen

Guilford Technical Institute - S. Jones

Middlesex County College - C. Turbyne

Southern Illinois University - C. Miera

University of Detroit - P. Shelton

Pilot test observer training

Cabrillo College - E. Hobbs, C. Miera

staff.) These comments indicated several minor problems and one major problem with the performance tests. The major problem involved the test in assisting with restorations. Early versions of this test called for the operator to direct the procedure, working from memory with the aid of a printed script. All five pretest operators found this procedure difficult and confusing. They suggested having one of the observers direct the procedure from instructions printed on the checklist, a suggestion that was subsequently adopted by the Working Committee. Of the other suggestions, some involved adding, deleting, or rephrasing individual checkpoints; others involved procedures for administering the tests.

Revision of test materials by the Working Committee. The Working Committee met on March 24 and 25, 1979, in New Orleans, Louisiana to review the pretest results and revise the examination. The committee made many revisions in the performance tests. Most of the revisions tended to simplify the test materials and procedures. Many checkpoints were deleted, and some checklist formats were changed to make the observer's task easier. The procedure for the test in assisting with restorations was placed under the direction of the observer rather than the operator.

Training of observers for the pilot test. The observers and operators from the pilot test sites that had not also been pretest sites attended a two-day training workshop on April 21 and 22, 1979 at Cabrillo College, Aptos, California. The workshop was conducted by the test site coordinators for Cabrillo College and for Des Moines Area Community College (where the previous workshop had been held) and an ETS staff member. Like the previous workshop, this one consisted mainly of practice sessions interspersed with debriefing sessions. Students in dental assisting and dental hygiene served

as examinees. Two members of the Working Committee were present, including one who was also a pilot test site coordinator and observer. As expected, the revised procedures went much more smoothly, and the observers did not encounter any serious problems in administering the tests or observing the examinees' performance. Only a few minor changes in the performance test materials were made as a result of this workshop experience.

Pilot testing. During May, June, and July of 1979 the examination was pilot tested at the selected pilot test sites. The pilot test was administered to a total of 115 examinees: 58 dental assistants and 57 dental hygienists. They were paid for their participation. Only the dental hygienists took the performance tests in the therapeutics module (periodontal dressing, coronal polishing, and polishing an amalgam restoration). Examinees at some of the test sites did not take the performance test in the taking of an alginate impression, because of state laws prohibiting auxiliaries from doing this procedure. In addition, some of the hygienists refused to attempt the performance test in assisting with restorations, on the grounds that they had not had any training or experience to prepare them to perform this function.

Table 9 summarizes the professional experience of the pilot test examinees. Most of the examinees had only one or two years' experience in their fields, but several had more. One of the dental assistants was a dental assisting instructor, and eleven of the dental hygienists were (or had been) dental hygiene instructors, eight of them for at least three years. None of the dental assistants had any experience in dental hygiene, although one had a year of instruction. However, fifteen of the dental hygienists had been dental assisting practitioners, and three had been dental assisting instructors.

Table 9. Summary of Professional Experience of Pilot Test Examinees.

	Dental Assistants	Dental Hygienists
Professional Credentials*		
CDA	53	5
RDA	6	0
RDH	0	57
Instruction in Dental Assisting		
None	0	50
1 year	50	5
2 or more years	8	2
Instruction in Dental Hygiene		
None	57	0
1 year	1	0
2 years	0	51
3 years	0	2
4 years	0	4
Experience as Dental Assisting Practitioner		
None	0	42
1 year	14	5
2 years	20	3
3 years	10	1
4 years	5	1
5 years	2	1
6 or more years	7	4

*Some persons held more than one professional credential.

	Dental Assistants	Dental Hygienists
Experience as Dental Hygiene Practitioner		
None	58	5
1 year	0	23
2 years	0	16
3 years	0	2
4 years	0	1
5 years	0	2
6 or more years	0	8
Experience as Dental Assisting Instructor		
None	57	54
1 year	0	2
2 years	0	1
3 years	0	0
4 years	0	0
5 years	1	0
Experience as Dental Hygiene Instructor		
None	58	46
1 year	0	3
2 years	0	0
3 years	0	2
4 years	0	3
5 years	0	2
6 years	0	1

The pilot test data from the performance tests was analyzed in the same way as for the pretest, to detect any performance checkpoints that still caused problems of inter-observer agreement and to identify checkpoints missed by a large proportion of the examinees whose performance was judged adequate by the observers. Performance test data from assistants and hygienists were analyzed together. Some additional analyses were done on the pilot test data from both the written tests and the performance tests, and these analyses will be reported in the following pages.

The pilot testing revealed substantial differences between test sites in the amount of time required to set up and administer the performance tests and in the cost of equipment and materials that had to be purchased for these tests. The differences in the time required to administer the performance tests were not as great as the dfferences in set-up time. The differences between test sites in set-up time were so great that any general statement as to the amount of set-up time required for each test would be misleading for a large proportion of the test sites.

Development of scoring formulas. The development of scoring formulas for the performance tests was a three-stage process. Before the pilot testing of the examination began, each member of the Working Committee received in the mail a set of the performance checklists, with a letter asking for a series of judgments made by the following procedure:

1. Identify any checkpoints that you think should be deleted. Give them a weight of zero. (There may or may not be any such checkpoints.)

2. Identify any checkpoints that you consider so important that any examinee who misses even one such checkpoint should receive a failing score for that portion of the examination. Indicate these checkpoints with an asterisk, instead of giving them a numerical weight. (Again, there may or may not be any such checkpoints.)

3. Identify the least important of the remaining checkpoints. Give each of them a weight of one.

4. Identify the most important of the remaining checkpoints. Decide how many points each of them should be worth. That is, how many of the low-importance checkpoints should equal one of the high-importance checkpoints? (One way to make this decision is to imagine an examinee who missed only one checkpoint -- the most important. How many of the least important checkpoints would a second examinee have to miss in order to deserve the same score as the first examinee?)

5. Assign weights to the remaining checkpoints by comparison with the most and least important. (You can use the same sort of reasoning as for step 4.)

The Working Committee members wrote their suggested scoring weights on the performance checklists and returned them to ETS. (Not all committee members suggested weights for all the performance tests; for example, none of the dental hygienists suggested scoring weights for the test in assisting with restorations.)

When the checklists arrived at ETS, the committee members' suggested scoring weights for each test were collated on a single master copy of the checklist. An ETS staff member reviewed the weights and assigned a single consensus weight to each checkpoint. ETS then printed copies of the performance checklists marked with these consensus weights (labeled "preliminary scoring weights") and sent them to the members of the Working Committee. With the performance checklists was a letter asking the committee members to review the preliminary scoring weights in preparation for the final meeting of the Working Committee. The committee members were to note any checkpoints they felt had been weighted too heavily or not heavily enough. The committee's review and revision of the scoring formulas at the meeting was the third and

final stage of the process. Table 10 shows the number of checkpoints and the range of scoring weights in each of the performance tests (except charting from dictation, which did not include a performance checklist).

Final review by the Working Committee. The Working Committee met on August 17, 18, and 19, 1979 in Boston, Massachusetts. In reviewing the performance tests and scoring formulas, the committee gave special consideration to those checkpoints that showed poor inter-observer agreement (less than 85 percent) and those that were missed by a large proportion of the examinees whose performance was judged adequate. The committee changed the wording of several of the checkpoints that showed poor inter-observer agreement. They also deleted some of the checkpoints and made several adjustments to the scoring formulas.

Scoring of the performance tests. Each performance test (except for the test in charting from dictation) was scored by a three-stage procedure. First, the scoring formulas were applied to each checklist separately. Then the resulting scores were converted to percentage terms, expressing the score as a percentage of the total possible score. This percentage scoring was necessary because of checkpoints left unmarked by the observers and because a small number of the performance checkpoints did not apply to all examinees (because of differences in equipment, patients, etc.). Finally, the scores computed from the two observers' checklists for each examinee were averaged to produce the examinee's score.

Table 11 presents the distributions of the pilot test examinees' scores on the performance tests. The scores on the test in assisting with restorations are quite high because the performance checklist includes checkpoints for a large number of errors that are rarely made, particularly in selecting

Table 10. Number of Checkpoints and Range of Scoring Weights for Performance Tests.

Test	Number of Checkpoints	Range of scoring weights
Assisting with restorations	382*	1 - 10
Surgical scrub	13	1 - 10
Oral hygiene instruction	21	1 - 5
Vital signs	27	1 - 10**
Radiography	155***	1 - 10
Alginate impression	65	1 - 10
Periodontal dressing	29	1 - 20
Coronal polishing	31	1 - 20
Polishing amalgam restoration	29	1 - 10
Study cast	37	1 - 10

* Includes several checkpoints for each instrument exchange.

** Reported measurements must be correct, within specified tolerances; otherwise the examinee fails the test.

*** Each feature to be demonstrated is counted here as a separate checkpoint. Number shown is maximum; actual number depends on patient.

Table 11. Distributions of Examinees' Scores on Performance Tests (average of two observers).

	Assisting with Restorations	Surgical Scrub	Oral Hygiene Instruction	Vital Signs	Radiography	Alginate Impression	Periodontal Dressing	Coronal Polishing	Polishing Amalgam Restoration	Study Cast
Test Score:										
96 - 100	38 (48%)	5 (4%)	1 (1%)	35 (30%)	0	8 (11%)	6 (12%)	8 (15%)	7 (12%)	3 (3%)
91 - 95	25 (31%)	5 (4%)	5 (4%)	7 (6%)	2 (2%)	13 (18%)	4 (8%)	2 (4%)	7 (12%)	7 (6%)
86 - 90	14 (18%)	7 (6%)	6 (5%)	28 (24%)	4 (3%)	26 (36%)	8 (16%)	7 (13%)	6 (11%)	6 (5%)
81 - 85	1 (1%)	9 (8%)	10 (9%)	14 (12%)	14 (12%)	16 (22%)	7 (14%)	9 (17%)	10 (18%)	4 (4%)
76 - 80	1 (1%)	9 (8%)	12 (11%)	7 (6%)	16 (14%)	3 (4%)	15 (29%)	9 (17%)	16 (28%)	9 (8%)
71 - 75	1 (1%)	5 (4%)	15 (13%)	14 (12%)	16 (14%)	4 (5%)	2 (4%)	6 (12%)	5 (9%)	17 (15%)
66 - 70	0	3 (3%)	15 (13%)	8 (7%)	20 (17%)	1 (1%)	2 (4%)	3 (6%)	3 (5%)	13 (12%)
61 - 65	0	5 (4%)	8 (7%)	1 (1%)	13 (11%)	0	2 (4%)	2 (4%)	1 (2%)	12 (11%)
56 - 60	0	5 (4%)	12 (11%)	1 (1%)	14 (12%)	2 (3%)	0	5 (10%)	0	11 (10%)
51 - 55	0	13 (11%)	8 (7%)	0	4 (3%)	0	3 (6%)	1 (2%)	0	7 (6%)
46 - 50	0	9 (8%)	7 (6%)	0	4 (3%)	0	0	0	0	8 (7%)
41 - 45	0	17 (14%)	4 (4%)	0	5 (4%)	0	2 (4%)	0	1 (2%)	7 (6%)
36 - 40	0	10 (9%)	5 (4%)	0	2 (2%)	0	2 (4%)	0	1 (2%)	2 (2%)
31 - 35	0	5 (4%)	3 (3%)	0	1 (1%)	0	0	0	0	2 (2%)
0 - 30	0	8 (7%)	2 (2%)	0	0	0	0	0	0	4 (4%)
Total Number of Examinees	80	115	113	115	115	73	51	52	57	112
Average Score	92.8	58.1	64.8	85.6	67.0	85.7	78.3	78.7	82.0	63.8
Standard Deviation	5.3	21.4	16.2	10.9	12.6	7.8	14.2	12.6	11.4	19.7

and delivering hand instruments. Each instrument exchange involves several possible errors, and, since these are not all equally important, the performance checklist contains a separate checkpoint for each. There is a great deal of variation in the examinees' scores on some of the performance tests, particularly the surgical scrub and the study cast.

The performance test in charting from dictation was different from the other performance tests in that the examinee's performance was not directly observed. Instead, the examinee was to answer a series of multiple-choice questions based on his/her own chart. Table 12 shows the distribution of scores on this test.

Inter-observer reliability of the performance tests. The use of two independent observers in the performance tests enabled ETS to investigate the inter-observer reliability of scores on those tests. This type of reliability can be described in several different ways, not all of which are relevant for criterion-referenced tests.* One type of information that is relevant for criterion-referenced tests is the size of the differences between observers' scores for the same examinees. Table 13 presents this information. Since the scores are expressed as percentages of the maximum possible score, the differences in Table 13 are in terms of percentage points. (For example, if the two observers' checklists for the same examinee yield scores of 80% and 84%, the size of the difference is four

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* Measures such as the intraclass correlation coefficient, which depend on the amount of variation between examinees in their true level of performance, are not relevant to criterion-referenced tests.

Table 12. Distribution of Scores on Performance Test in Charting from Dictation.

Test score	Number of Examinees
12	55 (48%)
11	38 (33%)
10	14 (12%)
9	4 (3%)
8	2 (2%)
7	0
6	2 (2%)
0 - 5	0
Total	115

Table 13. Distributions of Inter-Observer Differences on Performance Tests.

	Assisting with Restorations	Surgical Scrub	Oral Hygiene Instruction	Vital Signs	Radiography	Alginate Impression	Periodontal Dressing	Coronal Polishing	Polishing Amalgam Restoration	Study Cast
Difference size:										
0 - 5	76 (95%)	59 (51%)	54 (47%)	89 (77%)	83 (72%)	48 (66%)	29 (57%)	43 (83%)	40 (70%)	64 (57%)
6 - 10	3 (4%)	16 (14%)	23 (20%)	10 (9%)	17 (15%)	19 (26%)	8 (16%)	4 (8%)	7 (12%)	16 (14%)
11 - 15	0	7 (6%)	22 (19%)	11 (10%)	4 (3%)	3 (4%)	4 (8%)	2 (4%)	4 (7%)	20 (18%)
16 - 20	1 (1%)	8 (7%)	6 (5%)	2 (2%)	9 (8%)	2 (3%)	2 (4%)	1 (2%)	1 (2%)	6 (5%)
21 - 25	0	4 (3%)	3 (3%)	1 (1%)	1 (1%)	0	5 (10%)	1 (2%)	4 (7%)	4 (4%)
26 - 30	0	7 (6%)	4 (4%)	2 (2%)	1 (1%)	1 (1%)	1 (2%)	0	1 (2%)	1 (1%)
31 - 35	0	3 (3%)	0	0	0	0	0	1 (2%)	0	1 (1%)
36 or more	0	11 (10%)	1 (1%)	0	0	0	2 (4%)	0	0	0
Total Number of Examinees	80	115	113	115	115	73	51	52	57	112
Average difference size	1.4	10.7	7.3	3.6	3.9	4.0	8.0	3.6	4.5	6.1

percentage points.) The inter-observer reliability of most of the tests appears fairly good. However, the surgical scrub, oral hygiene instruction, and periodontal dressing seem to present some problems in inter-observer reliability. Some of the revisions made after pilot testing (changes in phrasing and sequencing of checkpoints) may improve the inter-observer reliability of the performance tests. However, in some cases the important points may simply be difficult to observe -- e.g., avoiding cross-contamination during the surgical scrub. In other cases, there may be no practical way to avoid the need for judgment by the observer -- e.g., in deciding whether or not an examinee has explained a particular point to the patient during oral hygiene instruction.

The data in Table 13 are totals for all the test sites combined. However, there were substantial differences between test sites in the inter-observer reliability of the performance tests. Table 14 shows the average difference between observers for each test at each institution involved in the pilot testing of the examination. A small number indicates that the inter-observer reliability of that test at that institution was good; a large number indicates poor inter-observer reliability. The numbers in Table 14 reveal some interesting facts. First, at some institutions the observers were able to observe all the performance tests reliably. Second, some institutions seem to have had inter-observer reliability problems for some of the tests but not others. Third, no institution seems to have had serious reliability problems with all the tests. The differences between institutions in inter-observer reliability may be associated with differences in the ways they administered the tests. If so, the inter-observer reliability of the performance tests could be potentially much

Table 14. Average Inter-Observer Difference for Performance Tests at Each Testing Institution.

	Testing Institution											
Performance Test:	1	2	3	4	5	6	7	8	9	10	11	12
Assisting with restorations	1.6	0.3	1.1	2.0	2.8	1.5	1.2	0.8	1.5	-	1.3	0.8
Surgical scrub	18.7	0.0	3.8	22.0	5.0	7.6	4.8	9.1	7.9	2.4	18.2	22.5
Oral hygiene instruction	8.7	1.6	8.4	8.9	10.1	2.6	4.5	14.7	7.0	3.2	10.1	5.2
Vital signs	3.7	0.1	2.6	1.4	5.5	2.7	1.8	4.6	8.0	0.0	4.3	6.5
Radiography	4.0	0.2	6.4	12.9	5.3	2.7	1.3	5.1	3.2	0.0	3.3	0.9
Alginate impressing	3.8	*	2.7	3.7	*	*	4.2	2.8	*	0.6	6.1	6.1
Periodontal dressing	10.2	*	5.8	7.2	5.4	0.4	*	8.0	22.2	0.8	8.0	11.6
Coronal polishing	2.2	0.0	0.8	2.6	4.6	2.8	*	6.2	5.8	2.4	8.0	*
Polishing amalgam restoration	10.4	0.2	1.0	1.8	5.6	0.0	*	2.0	8.8	*	5.8	8.4
Study cast	6.3	0.0	5.3	6.1	12.0	7.5	11.8	2.1	8.4	0.0	8.0	6.0

* Indicates test not given at that institution.

better than the overall figures would suggest. This possibility is worth investigating further.

Observers' judgments of examinee performance. Table 15 summarizes the observers' overall judgments of the examinees' performance. The total number of examinees listed for each test is less than the corresponding number in Tables 11 and 13 because in some cases one or both observers neglected to check either "adequate" or "inadequate." The observer's judgment for the performance test in taking vital signs is a combination of three separate judgments (for pulse rate, respiration rate, and blood pressure). A judgment of "adequate" for this test means that the examinee was judged adequate on all three parts of the test.

The observers' overall judgments disagreed about a substantial number of examinees on some of the tests, particularly the surgical scrub and the alginate impression. These disagreements can probably be attributed to two factors: (1) unreliability in the observation process, and (2) differences between observers in the standards by which they judged examinee performance. That is, the observers may have disagreed about what the examinee did, or they may have agreed about what the examinee did but disagreed as to whether or not it represented adequate performance. Unreliability of the observation process would be reflected in the examinees' scores, while differences in observers' standards generally would not. Since inter-observer reliability was a problem in the surgical scrub, it is not surprising to find a substantial number of disagreements in the observers' judgments on that test. The inter-observer reliability of the scores on the alginate impression test was not particularly poor. However, some of the specific checkpoints that discriminated best between adequate and inadequate performers were also the least

Table 15. Observers' Judgments of Examinees' Performance

Performance Test	Observers' Judgements		
	Both "adequate"	One "adequate," one "inadequate"	Both "inadequate"
Assisting with restorations	49 (72%)	5 (7%)	14 (21%)
Surgical scrub	26 (23%)	26 (23%)	59 (53%)
Oral hygiene instruction	43 (41%)	15 (14%)	47 (45%)
Vital signs	36 (37%)	11 (11%)	50 (52%)
Radiography	55 (63%)	10 (11%)	22 (25%)
Alginate impression	49 (69%)	15 (21%)	7 (10%)
Periodontal dressing	27 (61%)	5 (11%)	12 (27%)
Coronal polishing	21 (64%)	1 (3%)	11 (33%)
Polishing amalgam restoration	28 (54%)	6 (12%)	18 (35%)
Study cast	49 (52%)	11 (12%)	35 (37%)

reliable. In other words, some aspects of the procedure that the observers seem to have considered most important were those in which they were most likely to disagree about what the examinee had done. All of these checkpoints were in the evaluation of the finished impression. Possibly the inter-observer reliability of these checkpoints could be improved by giving the observers photographs of acceptable and unacceptable alginate impressions to use as examples, as is done in the radiography test. According to the observers' overall judgments, the examinees as a group seem to have performed best in assisting with restorations and in taking the alginate impression; worst in the surgical scrub. These judgments are consistent with the examinees' scores on the tests as shown in Table 11.

Development of the written tests

Content specifications. The content specifications for the written tests were determined at the same time as those for the performance tests. First the Advisory Committee reviewed the task analysis document and grouped the tasks into major categories. These categories were similar but not identical to those of the task analysis document. After grouping the tasks into categories, the committee suggested the degree of emphasis to be placed on each category. The committee also recommended that item writers consider the cognitive ability levels of Bloom's Taxonomy.*

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*Benjamin S. Bloom, Taxonomy of Educational Objectives: Cognitive Domain. New York, David McKay, 1956.

At the first meeting of the Working Committee the Written Test Subcommittee reviewed the task statements in the task analysis document, making changes they deemed appropriate. They reviewed and revised the content specifications suggested by the Advisory Committee and classified each task into the appropriate content category. The subcommittee reviewed several approaches to the abilities dimension and decided to ask the persons writing the test items (questions) to write at the "knowledge" and "application" levels of Bloom's Taxonomy. The members of the subcommittee then wrote a number of prototype questions illustrating each task and ability level. These prototype questions were included in the materials that ETS sent to the item writers.

Writing of test items. The tests in the Proficiency Examination are criterion-referenced tests, which are, by definition, "deliberately constructed to yield measurements that are interpretable in terms of specified performance standards."* This fact has some important implications for the writing of test items, which have been expressed as follows in another well-known article on the subject:

> "The basic difference between item construction in norm-referenced and criterion-referenced frameworks is a matter of "set" on the part of the item writer. . .
>
> Most important, when a writer constructs items for a norm-referenced test, he wants variability and, as a consequence, makes all sorts of concessions, sometimes subtle, sometimes obvious, to promote variant scores. He disdains items which are "too easy" or "too hard." He tries to increase the allure of wrong answer options. . .

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*Robert Glaser, "A criterion-referenced test," in W. James Popham (ed.) Criterion-Referenced Measurement. Englewood Cliffs, N.J.: Educational Technology Publications, 1971.

> The criterion-referenced item writer is guided by another goal. His chief rule is to make sure the item is an accurate reflection of the criterion behavior. Difficult or easy, discriminating or indiscriminate, the important thing is to make the item represent the class of behaviors delimited by the criterion. Those who write criterion-referenced items are usually far more attentive to defining the domain of relevant test responses and the situations in which they should be required. This rather fundamental difference in "set" on the part of criterion-referenced and norm-referenced item writers can clearly contribute to differences in the resulting items."*

ETS selected 22 persons to write the multiple-choice items, selecting from the same lists used to select persons for the Working Committee, augmented by additional suggestions from members of the Advisory Committee and the Working Committee. ETS contracted with each item writer for twenty items in a specified content area, so that the number of items written in each content area was approximately twice the number needed. (The purpose of this "overage" was to allow for the deletion of items that were redundant with each other or in some way inappropriate for the examination.) ETS provided each item writer with four types of information:

1. Task statements for the dental auxiliary tasks about which the item writer was to write questions;
2. A description of the desired cognitive ability levels, "knowledge" and "application," and examples of questions written at these cognitive ability levels;
3. A set of instructions for writing good test questions, including examples of questions illustrating these instructions;
4. Descriptions of the item formats to be used in the Proficiency Examination.

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*W. James Popham and T. R. Husek, "Implications of Criterion-referenced measurement," Journal of Educational Measurement, 1969, Vol. 6, no. 1, pp. 1-9.

The item writers sent their test items to ETS, where ETS test developers edited them for style, grammar, and format and reviewed them for certain types of flaws commonly found in multiple-choice items.

Review by subcommittee. The Written Test Subcommittee met in Alexandria, Virginia on August 18, 19, and 20, 1978. Before the meeting, each subcommittee member had received a copy of all the items to be reviewed. The subcommittee members were asked to answer each item (without benefit of the answer key) and to rate each item on three separate criteria: technical quality, significance of content, and appropriateness for the assigned category in the test specifications. In addition, the subcommittee members were to offer any suggestions they had for improving the item. The instructions to the subcommittee members emphasized two major themes they were to keep in mind when reviewing each test item:

1. "Is it job-related?"
2. "Is it appropriate for an entry-level dental auxiliary?"

The items, with the subcommittee members' answers, ratings, and comments, were mailed to ETS, where they were collated and duplicated so that each subcommittee member could see all the members' responses to an item at once. At the subcommittee meeting the members reviewed their responses and ratings of each item. They then decided, for each item, to accept it without revision, to revise it, or to delete it from the item pool. Of 430 items submitted, 315 survived this review process. In one or two of the specified content categories the number of items that survived the review process was less than the number called for in the specifications. Members of the sub-

committee volunteered to write additional items in these categories to meet the specifications.

Review by committees. Before the written test items were assembled into booklet form for pretesting, they were reviewed by the full Working Committee and the Advisory Committee. The Working Committee reviewed each written test item individually to make sure that its technical content was correct, important, and appropriate for the examination and that its language was correct and appropriate. Several items were revised, some were deleted. The Working Committee also identified a subset of items in diagnostic aids, therapeutics, and patient education as appropriate for dental hygienists but not for dental assistants. The Advisory Committee also reviewed the written test items and suggested revisions to several of the items.

Pretesting and revision of the written test items. The written tests were pretested on a total of 24 examinees at the five test sites. The pretest data from the written tests were analyzed separately for each of the five competency areas. The examinees were divided into two groups on the basis of their scores. Questions missed frequently by members of the high-scoring group were identified for special review, to detect ambiguities of phrasing, "correct" answers that might under some circumstances be incorrect, and "incorrect" answers that might under some circumstances be correct. Although this type of analysis is commonly used in constructing norm-referenced tests, it is appropriate for criterion-referenced tests as well. The difference lies in the decisions made as a result of the analysis:

> "Item analysis procedures have traditionally been used with norm-referenced tests to identify those items that were not properly discriminating among individuals taking the test. For instance, in an achievement test an unsatisfactory item would be one which could not

> properly discriminate between the more and less knowledgeable learners (as reflected by total test performance). Non-discriminating items are usually those which are (a) too easy, (b) too hard, and/or (c) ambiguous.
>
> For criterion-referenced tests the use of discrimination indices must be modified. An item which doesn't discriminate need not be eliminated. . .
>
> However, negatively discriminating items are treated exactly the same way in a criterion-referenced approach as they are in a norm-referenced approach. An item which discriminates negatively is one which, in an instructional context, is answered correctly more often by the less knowledgeable than by the more knowledgeable students. When one discovers a negative discriminator in his pool of criterion-referenced items, he should be suspicious of it and after more careful analysis can usually detect flaws in such an item."*

The Working Committee reviewed the test items and the pretest data at the committee's third meeting, paying special attention to the items identified as possibly defective on the basis of the pretest data. Committee members rewrote several of these items. Pretesting had also indicated that the written tests required less time than had been anticipated, and the committee agreed to keep a larger-than-anticipated number of questions in the written tests and to shorten the testing time.

Pilot testing of the written tests. A total of 115 examinees -- 58 dental assistants and 57 dental hygienists -- took the written tests during the pilot testing. Because some of the test questions had been identified as appropriate for dental assistants but not for dental hygienists, ETS printed two different examination booklets. The tests in chairside assisting and in laboratory procedures were the same in both booklets. For the tests in patient education, diagnostic aids, and therapeutics, the hygienists' booklet contained the longer versions and the assistants' booklet contained

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*W. James Popham and T. R. Husek, op. cit.

the shorter versions. The time limits for these three tests were adjusted accordingly. The written tests were scored without a penalty for incorrect guessing. The time limits were ample; all examinees completed all five written tests. The scores are summarized in Table 16, where they are expressed in percent-correct terms. Although the tests were constructed to measure entry-level knowledge and skills and the pilot test examinees were all Certified Dental Assistants, Registered Dental Assistants, or Registered Dental Hygienists, their scores did not tend to cluster in the highest score brackets on most of the tests.

Reliability of the written tests. Reliability is the tendency of a test to give consistent scores -- scores that change very little even when the particular set of questions on the test is replaced by another set of questions testing the same topics. The extent to which the scores could be expected to change is indicated by a statistic called the "standard error of measurement". This statistic represents the difference between the score an examinee actually made and the average of all the scores the examinee would make if he or she could somehow take all possible versions of the test. The standard error of measurement is the estimated average size of these differences for all examinees taking the test. The smaller the standard error of measurement is, in relation to the length of the test, the more reliable the test scores are. Table 17 shows the standard error of measurement for each of the written tests, based on the pilot test data. The number "3.4" in the first line of Table 17 can be interpreted as follows: Suppose ETS were to construct a large number of written tests in chairside assisting, each consisting of 64 questions on the specified topics. Suppose the pilot test examinees had taken all of these tests and

Table 16. Distributions of Scores on Written Tests.

Test	Chairside Assisting	Patient Education		Diagnostic Aids		Therapeutics		Laboratory Procedures
Number of questions	64	26*	40**	49*	60**	15*	36**	28
Percent correct								
91 - 100	0	0	6 (11%)	0	3 (5%)	1 (2%)	1 (2%)	0
81 - 90	7 (6%)	13 (22%)	35 (61%)	17 (29%)	40 (70%)	4 (7%)	16 (28%)	17 (15%)
71 - 80	32 (28%)	17 (29%)	16 (28%)	22 (38%)	11 (19%)	16 (28%)	23 (40%)	35 (30%)
61 - 70	49 (43%)	23 (40%)	0	15 (26%)	3 (5%)	14 (24%)	14 (25%)	47 (41%)
51 - 60	20 (17%)	3 (5%)	0	4 (7%)	0	13 (22%)	2 (4%)	12 (10%)
41 - 50	5 (4%)	2 (3%)	0	0	0	8 (14%)	1 (2%)	3 (3%)
31 - 40	2 (2%)	0	0	0	0	1 (2%)	0	1 (1%)
0 - 30	0	0	0	0	0	1 (2%)	0	0
Number of examinees	115	58	57	58	57	58	57	115
Average percent correct	66.0	71.2	84.4	74.8	83.4	64.8	74.5	68.9
Standard deviation (% correct)	9.2	8.5	5.6	9.1	6.0	14.2	8.3	9.4

*Assistants' version
**Hygienists' version

Note: Because the hygienists' version of the tests in patient education, diagnostic aids, and therapeutics contained several questions not on the assistants' version; scores on the two versions are not comparable.

Table 17. Standard Error of Measurement of the Written Tests.

Test	Number of questions	Standard error of measurement
Chairside assisting	64	3.4
Patient education		
assistants' version	26	1.9
hygienists' version	40	2.0
Diagnostic aids		
assistants' version	49	2.7
hygienists' version	60	2.6
Therapeutics		
assistants' version	15	1.7
hygienists' version	36	2.3
Laboratory procedures	28	2.1

ETS had computed each examinee's average score over all the tests in chair-side assisting. A typical examinee could expect to find a difference of 3.4 questions correct (equal to 5.3 percentage points) between his or her score on any one of these tests and his or her long-term average score.

Estimated reading difficulty of the written tests. ETS staff computed the estimated reading difficulty of each of the written tests by applying the "SMOG" index to the tests in their finished form.* The SMOG index gives the estimated reading difficulty of a written passage in grade-level terms. That is, if a passage has a difficulty level of 10, it can be read and understood fully by a person who reads as well as an average tenth-grade student but not by a person who reads only as well as an average ninth-grade student. The estimated reading difficulty levels of the written tests ranged from 10.3 to 10.8. Therefore, an examinee who reads as well as an average 11th-grade student should have no difficulty in reading the test.

Estimated reading difficulty is a function of two factors: sentence length and frequency of difficult or unfamiliar words. (The SMOG index uses the number of words of three or more syllables as an indicator of the number of difficult words.) Inspection of the written tests revealed that it would be possible to reduce their estimated reading difficulty (and presumably their actual reading difficulty as well) to some degree by breaking up some long sentences into shorter ones. However, many of the longer words are technical terms. Any rephrasing of the questions would have to be reviewed for technical correctness.

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*G. H. McLaughlin: "SMOG grading: A new readability formula," Journal of Reading, 1969, Vol. 12, pp. 639-646.

Recommendations for Pass/Fail Cutoff Scores

If a test consisted of only a single question or checkpoint, choosing a pass/fail cutoff score would not be a problem. Any examinee who answered or performed correctly would pass; any examinee who answered or performed incorrectly would fail. But when the results of many questions or checkpoints are combined into a single score, someone must decide how high a score to require for an examinee to pass the test. Unfortunately, even the best examinees -- persons who are undoubtedly proficient in the subject of the test -- rarely get perfect scores. Therefore, the process of choosing a pass/fail cutoff score requires some form of judgment.

The judgments involved in choosing a pass/fail cutoff score must be made by persons who are qualified to make them, and they must be made in a way that is meaningful and realistic. It is possible simply to have the judges examine the test and choose a particular score as the pass/fail cutoff. However, experience has shown that this simple method often results in cutoff scores that are clearly unrealistic, in that large members of competent examinees would fail the test if the resulting cutoff score were used. As a result, several alternative methods have been proposed. These methods can generally be categorized into two groups. One group consists of methods based on judgments as to the way a hypothetical "minimally qualified" examinee would perform on the test. This "minimally qualified" examinee is the borderline case -- the examinee whose proficiency just barely meets the standard. These methods do not require the actual identification of any such examinees. Instead, the judges are asked to think of real or imaginary persons who fit the definition and make an informed guess -- a conjecture -- as to how these persons would perform on the test. Therefore, these methods

can be called "conjectural methods." The second group consists of methods based on judgments of the proficiency of real examinees whose test scores are known. These methods require the collection of data in the form of the examinees' test scores and the judges' evaluation of the examinees' proficiency. Because these methods are based on observed data, they can be called "empirical methods."

Making informed guesses about the test performance of a hypothetical "minimally qualified" examinee is a somewhat abstract and unfamiliar task. Making judgments about the proficiency of real persons is a fairly concrete and familiar task, particularly for instructors and supervisors of persons in the job for which the examinee is being tested (although individual judges may differ in the standards they apply). Therefore, the empirical methods are generally preferable to the conjectural methods -- if the necessary data can be obtained. This is sometimes a difficult requirement, since the judges must have enough information about the examinees to make meaningful judgments. Also, the judges' evaluations must be independent of the examinees' test scores, at least to the extent that the judges do not know the examinees' scores at the time they make the judgments. Fortunately, this type of data was obtainable from the pilot testing of the performance tests (except for charting from dictation), since each examinee's performance was observed by two observers who were qualified in the tasks involved in the test. The observers made their judgments after observing the examinee's performance, by checking one of two spaces, one marked "adequate" and the other "inadequate." Since the observers in the pilot testing did not know the scoring formulas, their judgments were made independently of the examinees' scores. (In fact, the final determination of the scoring formulas had not been made at the time of the pilot testing.) However, for the written

test no such judgments were obtainable. Each of the written tests measured a broad range of knowledge. It was not possible to obtain a judgment of the adequacy of each examinee's knowledge from a person qualified to make such a judgment. Therefore, ETS chose an empirical method for the performance tests (except for charting from dictation, in which the examinee's chart was not directly observed) and a conjectural method for the written tests and the performance test in charting from dictation.

Cutoff scores for the performance tests.

The method ETS used to recommend cutoff scores for the performance tests is an application of statistical decision theory. In this method, the examinees' test scores and the observers' judgments are used to estimate the relationship between an examinee's test score and the probability that an observer would judge the examinee's performance to be adequate.

Table 18 shows the distributions of performance test scores, classified according to the observer's overall judgment of the examinee's performance. Each checklist is counted separately in this table, so that an examinee who was judged adequate by one observer and inadequate by the other observer would be counted once in each column. The scores for examinees judged adequate are, of course, higher than those for examinees judged inadequate, but there is a substantial overlap. There are at least two factors that could have caused this overlap in the distributions. First, the observers undoubtedly varied somewhat in the standards by which they judged the examinees' performance. Second, the observers' criteria for judging examinees' performance may have differed from the criteria embodied in the scoring formulas. The estimates of the probability that an examinee with a given test score would be judged

Table 18. Distributions of Performance Test Scores, Classified by Observer's Judgment.
(A = "adequate;" I = "inadequate")

Performance Test	Assisting with Restorations		Surgical Scrub		Oral Hygiene Instruction		Vital Signs		Radiography		Alginate Impression	
Observer's judgment	A	I	A	I	A	I	A	I	A	I	A	I
Test Score												
96 - 100	68	5	9	0	5	0	65	9	0	0	21	0
91 - 95	36	11	15	0	3	1	3	1	5	0	20	1
86 - 90	6	16	11	9	6	2	13	37	7	0	45	7
81 - 85	0	4	11	4	18	1	3	22	17	0	19	7
76 - 80	0	0	12	6	17	3	0	9	23	2	6	5
71 - 75	0	0	2	4	15	10	2	26	24	5	4	5
66 - 70	0	0	3	1	20	9	3	14	21	9	0	1
61 - 65	0	0	1	6	7	8	0	2	14	6	0	1
56 - 60	0	0	2	3	6	17	0	1	9	18	0	0
51 - 55	0	0	4	20	2	9	0	0	4	4	0	1
46 - 50	0	0	1	9	6	8	0	0	3	4	0	1
41 - 45	0	0	2	33	2	4	0	0	2	9	0	0
36 - 40	0	0	4	20	2	12	0	0	0	0	0	0
31 - 35	0	0	1	9	0	7	0	0	0	0	0	0
0 - 30	0	0	0	23	0	3	0	0	0	0	0	0
Number of checklists	110	36	78	147	109	94	89	121	129	57	115	29

Table 18. (continued)

Performance Test	Periodontal Dressing		Coronal Polishing		Polishing Amalgam Restoration		Study Cast	
Observer's judgment	A	I	A	I	A	I	A	I
Test Score								
96 - 100	9	0	13	1	15	0	9	0
91 - 95	10	14	6	0	19	0	9	0
86 - 90	13	0	7	1	4	1	12	1
81 - 85	11	7	7	4	17	8	9	2
76 - 80	13	5	9	7	9	15	10	6
71 - 75	1	2	5	3	1	7	27	7
66 - 70	1	5	2	3	1	7	11	5
61 - 65	0	0	3	1	1	1	10	6
56 - 60	0	1	1	4	0	0	8	7
51 - 55	1	1	1	2	0	0	3	11
46 - 50	3	3	0	0	0	0	3	11
41 - 45	0	1	0	0	0	2	0	15
36 - 40	0	1	0	0	0	1	0	3
31 - 35	0	0	0	0	0	0	2	4
0 - 30	0	1	0	0	0	0	1	4
Number of checklists	62	31	54	26	67	42	114	82

adequate are shown in Table 19. Obviously, the relationship between test score and probability of being judged adequate at the tasks tested varies greatly from test to test.

To use information of this type to choose a pass/fail cutoff, one must first specify the relative seriousness of the two types of decision errors that might be made: (1) passing an inadequate performer, and (2) failing an adequate performer. Statistical decision theory tells us to choose the pass/fail cutoff that will minimize the total harm from the decision errors that will be made. If the two types of errors are equally serious, the decision maker should simply try to minimize the number of decision errors. If an examinee's test score indicates that the examinee would be more likely to be judged adequate than inadequate, the examinee should pass. The cutoff should be the score at which the examinee is as likely to be judged adequate as inadequate -- the score that corresponds to a .50 probability of being judged adequate.

What if the two types of errors are not equally serious? For example, suppose it is twice as harmful to pass an inadequate performer as to fail an adequate performer? In this case, the cutoff should be the score at which the examinee is twice as likely to be judged adequate as inadequate. This is the score that corresponds to a .67 probability of being judged adequate. Table 20 shows the recommended cutoff scores for several such ratios of importance of avoiding the two error types (which decision theorists often refer to as the "ratio of regrets"). At the final Working Committee meeting, the committee members were asked to judge the relative importance of the two types of decision errors for each of the performance tests. After discussion, the committee agreed on a ratio of 2:1 (indicating that the

Table 19. Estimated Probability That an Examinee's Performance Would be Judged Adequate.

Test:		Assisting with Restorations	Surgical Scrub	Oral Hygiene Instruction	Vital Signs	Radiography	Alginate Impression	Periodontal Dressing	Coronal Polishing	Polishing Amalgam Restoration	Study Cast
Score:	100	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	95	.90	.92	.96	.81	1.00	.99	.96	.95	1.00	.98
	90	.47	.80	.90	.60	1.00	.94	.87	.91	.94	.94
	85	.10	.71	.86	.33	.98	.82	.80	.80	.75	.85
	80	.00	.65	.81	.18	.94	.62	.67	.65	.57	.80
	75	.00	.59	.74	.11	.85	.46	.55	.55	.33	.76
	70	.00	.54	.65	.09	.76	.30	.42	.51	.14	.74
	65	.00	.48	.57	.06	.61	.10	.37	.48	.13	.65
	60	.00	.36	.48	.03	.53	.00	.35	.42	.08	.50
	55	.00	.27	.35	.01	.43	.00	.35	.28	.01	.33
	50	.00	.16	.28	.00	.39	.00	.32	.12	.00	.25
	45	.00	.12	.22	.00	.28	.00	.25	.03	.00	.18
	40	.00	.10	.16	.00	.16	.00	.11	.00	.00	.17

Table 20. Recommended Pass/Fail Cutoff Scores for the Performance Tests and Resulting Failure Rates for Pilot Test Examinees. (Scores are Expressed as Percent of Possible Score.)

Ratio of Regrets *	1:2		1:1		2:1		3:1		4:1	
	cutoff score	failure rate	cutoff score	failure rate	cutoff score	failure rate	cutoff score	failure rate	cutoff score	failure rate
Assisting with restorations	88	15%	91	23%	92	26%	93	34%	94	45%
Surgical scrub	59	57%	67	64%	81	77%	87	87%	90	91%
Oral hygiene instruction	59	34%	65	43%	70	57%	74	67%	76	73%
Vital signs	83	34%	88	62%	92	64%	94	68%	95	70%
Radiography	48	8%	59	23%	67	44%	70	55%	72	63%
Alginate impression	72	4%	77	12%	82	19%	84	30%	85	36%
Periodontal	53	8%	73	22%	81	55%	84	63%	86	65%
Coronal polishing	58	10%	65	15%	82	60%	84	64%	85	67%
Polishing amalgam restoration	74	19%	79	39%	82	49%	85	63%	88	70%
Study cast	55	27%	60	37%	66	48%	73	66%	80	82%

*Relative importance of avoiding the two types of possible decision errors, e.g., "4:1" means "if it is four times as harmful to pass an inadequate performer as to fail an adequate performer."

former type of error is twice as serious as the latter) for the performance tests in chairside assisting, diagnostic aids, and dental therapeutics, and a ratio of 1:1 (indicating that the two types of errors are equally serious) for the performance tests in patient education and laboratory procedures. One member of the committee dissented, maintaining that the two types of errors were equally serious for all the performance tests.

Cutoff scores for the written tests

Because of the difficulty of obtaining direct judgments of examinees' proficiency in the knowledge tested in the written tests, ETS decided to use a conjectural method for recommending cutoff scores on the written tests. Three basic methods of this type have been proposed; they are usually identified by the names of the authors who first proposed them. "Ebel's method"* calls for the judges to classify the test questions according to their difficulty and importance and then to judge what proportion of the questions in each category a minimally competent examinee would answer correctly. "Angoff's method"** calls for the judges to state the probability that a minimally competent examinee would answer each question correctly (or, alternatively, what percentage of a large group of such examinees would answer

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*Robert L. Ebel, Essentials of Educational Measurement: Englewood Cliffs, New Jersey; Prentice-Hall, 1972, pp. 492-494.

**William Angoff, "Scales, norms, and equivalent scores," in R. L. Thorndike (ed.), Educational Measurement: Washington, DC; American Council on Education, 1971, p. 531.

each question correctly). "Nedelsky's method"* calls for the judges to determine which wrong answers the minimally competent examinee would be able to eliminate from consideration.

Only a small amount of research has been done to attempt to determine the probable effects of using one or another of the conjectural methods. One study** compared Ebel's method with Nedelsky's and found that Ebel's method resulted in systematically higher cutoff scores. Another study*** compared Nedelsky's method with an empirical method (assuming equal importance of the two types of decision errors) and found no consistent tendency of the Nedelsky method to produce cutoff scores that were either higher or lower than those produced by the empirical method.

ETS tried all three conjectural methods at the fourth Working Committee meeting. The committee members served as judges, although not all the members completed all three methods. They made their judgments without any information about the performance of the pilot test examinees. Table 21 presents the cutoff scores as computed from the judgments of each committee member under each method, and the resulting failure rates in the pilot test examinee group. Judges 1, 2, 3, and 4 were dental assistants; they judged the assistants'

*Leo Nedelsky, "Absolute grading standards for objective tests," Educational and Psychological Measurement, 1954, Vol. 14 no. 1, pp. 3-19.

**Barbara J. Andrew and James T. Hecht, A preliminary investigation of two procedures for setting examination standards. Educational and Psychological Measurement, 1976. Vol. 36 No. 1, pp. 45-50.

***Stephen L. Koffler, A comparison of approaches for setting proficiency standards. Unpublished manuscript, Trenton, New Jersey: New Jersey Department of Education, 1979.

Table 21. Written Test Cutoff Scores by Three Different Methods and Resulting Failure Rates for Pilot Test Examinees

		Chairside Assisting 64 Items			Patient Education Assistants: 26 Items			Patient Education Hygienists: 40 Items			Diagnostic Aids Assistants: 49 Items		
		Ebel	Angoff	Nedelsky	Ebel	Angoff	Nedelsky	Ebel	Angoff	Nedelsky	Ebel	Angoff	Nedelsky
Judge 1	Cutoff score	50	45	41	21	19	17	--	--	--	40	34	37
	Failure rate	90%	66%	36%	78%	48%	17%				71%	26%	40%
Judge 2	Cutoff score	47	46	42	21	21	23	--	--	--	36	34	38
	Failure rate	77%	74%	40%	78%	78%	98%				38%	26%	52%
Judge 3	Cutoff score	51	49	--	21	16	--	--	--	--	38	34	--
	Failure rate	93%	87%		78%	9%					52%	26%	
Judge 4	Cutoff score	--	--	--	--	--	16	--	--	--	--	--	--
	Failure rate						9%						
Judge 5	Cutoff score	56	--	--	-	22	15	33	33	24	--	42	33
	Failure rate	100%				95%	7%	28%	28%	0%		86%	21%
Judge 6	Cutoff score	60	--	--	--	22	20	37	34	30	--	41	38
	Failure rate	100%				95%	66%	90%	42%	4%		74%	52%
Judge 7	Cutoff score	57	53	48	--	22	19	33	33	31	--	41	36
	Failure rate	100%	97%	84%		95%	48%	28%	28%	9%		74%	38%
Judge 8	Cutoff score	--	--	41	--	--	21	--	--	32	--	--	34
	Failure rate			36%			78%			16%			26%

Table 21 (continued)

		Diagnostic Aids Hygienists: 60 Items			Therapeutics Assistants: 15 Items			Therapeutics Hygienists: 36 Items			Laboratory Procedures 28 Items		
		Ebel	Angoff	Nedelsky	Ebel	Angoff	Nedelsky	Ebel	Angoff	Nedelsky	Ebel	Angoff	Nedelsky
Judge 1	Cutoff score	--	--	--	12	11	10	--	--	--	23	20	19
	Failure rate				80%	64%	40%				83%	40%	30%
Judge 2	Cutoff score	--	--	--	11	11	14	--	--	--	20	20	20
	Failure rate				64%	64%	98%				40%	40%	40%
Judge 3	Cutoff score	--	--	--	12	10	--	--	--	--	22	29	--
	Failure rate				80%	80%	40%				69%	40%	
Judge 4	Cutoff score	--	--	--	--	--	--	--	--	--	--	--	--
	Failure rate												
Judge 5	Cutoff score	53	52	41	--	13	11	32	31	27	25	24	22
	Failure rate	74%	63%	2%		91%	64%	98%	91%	42%	96%	87%	69%
Judge 6	Cutoff score	58	52	48	--	13	12	35	31	27	25	24	18
	Failure rate	100%	63%	23%		91%	80%	100%	91%	42%	96%	87%	17%
Judge 7	Cutoff score	50	50	44	--	12	11	33	31	25	23	23	19
	Failure rate	30%	30%	7%		80%	64%	98%	91%	20%	83%	83%	30%
Judge 8	Cutoff score	--	--	41	--	--	13	--	--	26	--	--	21
	Failure rate			2%			80%			30%			57%

version of the tests in patient education, diagnostic aids, and therapeutics. Judges 5, 6, and 7, who were dental hygienists, and Judge 8, who was a dentist, all judged the hygienists' version.

In general, Ebel's method produced higher cutoff scores than Angoff's or Nedelsky's . However, all three methods produced at least one or two cutoff scores that seem unrealistically high, considering that the examinees were practicing dental assistants and dental hygienists holding current credentials. One possible reason for the very high cutoff scores might be the fact that the judges were the same persons who had developed the test. As an informal test of this hypothesis, an ETS staff member instructed the two dentists and the two dental hygienists on the Advisory Committee in the Nedelsky procedure and asked them to apply it to one of the shorter written tests. The resulting cutoff scores were substantially lower than those computed from the judgments made by the Working Committee members. ETS therefore recommends that, before the written tests are used for credentialing purposes, another set of judgments should be collected, this time from persons who were not involved in the development of the examination. If cutoff scores must be chosen without the benefit of another set of judgments, ETS recommends that the cutoff score for each test be the median of the cutoff scores from the Nedelsky method. These cutoff scores are shown in Table 22. In percent-correct terms, the cutoff scores for the written tests range from 64 percent to 75 percent correct. The corresponding failure rates in the full pilot test examinee group (assistants and hygienists combined) range from 20 percent to 47 percent. These failure

Table 22. Suggested Cutoff Scores for the Written Tests (pending further investigation).

Test		No. of Items	Cutoff score
Chairside assisting		64	41
Patient education:	assistants	26	19
	hygienists	40	30
Diagnostic aids :	assistants	49	36
	hygienists	60	42
Therapeutics :	assistants	15	11
	hygienists	36	26
Laboratory procedures		28	19

rates seem somewhat high, but they are not generally higher than the proportions of examinees judged inadequate on the performance tests, and therefore do not seem wildly unrealistic.

The performance test in charting from dictation does not involve direct observation of the examinees' charts. Instead, the examinee uses his/her chart to answer twelve multiple-choice questions about specific features that were to be charted. Members of the Working Committee were asked to apply the Nedelsky Method to this test. Six members responded: Judges 1, 2, and 5 (as identified in Table 21) set the cutoff score at 11; Judge 6 set it at 10; and Judges 7 and 8 set it at 12. The median of these -- and therefore the recommended cutoff score -- is eleven correct answers to the twelve questions. This cutoff would have failed 19% of the pilot test examinees. A cutoff of 10 would have failed only 7%; a cutoff of 12 would have failed 52%.

Recommendations and Conclusions

Eligibility requirements for examinees

Both the Working Committee and the Advisory Committee discussed the issue of eligibility requirements for examinees at their final meetings. Both committees endorsed formal education for dental assistants and dental hygienists and recommended that the Proficiency Examination be made available for testing of graduates of programs accredited by the American Dental Association, Commission on Accreditation of Dental and Dental Auxiliary Educational Programs. The successful completion of all modules by these examinees would indicate general proficiency in dental assisting or, with the successful completion of a performance test in calculus removal, dental hygiene, as well as in the specific knowledge and skills tested in the examination.

The Advisory Committee and the Working Committee also recognized that the Proficiency Examination could be given to examinees who are not graduates of accredited programs in dental assisting or dental hygiene*. The two commmittees recommended that, for these examinees, the Proficiency Examination should be used only as an indication of proficiency in the knowledge and skills tested, and not as a complete evaluation of the examinee's general proficiency in dental assisting or dental hygiene.

Separate modules of the examination

The Advisory Committee and the Working Committee discussed the possibility that a credentialing agency might want to use only a portion of this examination and the possibility that an individual examinee might want to be

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*For example, persons trained on the job or in the military.

credentialed in some but not all competency areas. The committees recommended that the individual modules of the examination could be used separately, provided that each examinee takes both the written and performance portions of each module he/she takes.

Observers for the Performance Tests

Training of observers. The observer's role in the performance tests is critical. The performance test scores will be valid only if the observers have accurately recorded the examinees' actions during the tests. The observer's task is also a difficult one. The observer must know what specific actions to watch for, how to recognize them when they happen, and where to record them on the chart. The observer must be able to record each specified action quickly, so as not to miss the next. The observer's task is complicated by the fact that examinees do not all do the specified actions in the same order. Therefore, the observers cannot be expected to do an adequate job unless they have had the opportunity to practice using the performance checklists to record the performance of persons doing the tasks included in the performance tests. In addition, each observer should have the opportunity to discuss the interpretation and use of the checklists with other observers, after this first practice observation. Every observer should have these opportunities before serving as an observer of actual candidates for credentialing.

How many observers? One of the greatest impediments to the use of performance tests is the cost of administering them. A major component of this cost is observer time. One obvious way to reduce the amount of observer time required for the performance tests in the Proficiency Examination is to use only one observer per examinee. Neither the Working Committee nor the

Advisory Committee endorsed this solution. In some cases a compromise solution might be possible--the use of a second observer for those checkpoints that describe aspects of the product of the task, rather than the process. This compromise solution could be used with the performance tests in placing and removing a periodontal dressing, preparing a study cast, taking an alginate impression, polishing an amalgam restoration, taking vital signs, and coronal polishing.

One examinee at a time for each observer is probably the practical limit. Observing one examinee at a time is difficult enough; observing two at a time and accurately recording their performance could result in confusion, invalid scores, and inadequate protection of the patient (for those tests that use real patients). One possible exception to this rule is the performance test in dental radiography, in which the observer does not observe the entire procedure.

Administration of the performance tests

A credentialing agency planning to administer the performance tests to any substantial number of examinees will have to confront several problems of logistics: providing equipment and materials, training observers, arranging for patients, scheduling of the tests, set-up of the testing area, verification of candidates' identity, handling and scoring of the performance checklists, and probably other problems as well. Solving these problems is beyond the scope of the present project, but they will need to be resolved before the performance tests can be used operationally. Further experience with the performance tests will be necessary to find the most practical and efficient ways of administering them to larger numbers of examinees.

Additional test development

If the Proficiency Examination is to become the basis for an ongoing program for credentialing dental auxiliaries, some additional test development work will be needed.

Alternate forms of the written tests. Alternate forms are necessary to prevent the specific questions on the test from being known in advance by examinees. If examinees know the specific questions they will be asked, their answers to those questions will not be a valid sample of their knowledge of the topics tested. Therefore, now that the development of a Proficiency Examination has been shown to be practical, ETS recommends that one or more additional forms of the written tests be developed.

Alternate forms of the performance tests. Most of the performance tests will not require alternate forms. Unlike the written tests, they each test an entire task, not a sample of discrete points of knowledge. However, the performance tests in assisting with restorations, placing and removing a periodontal dressing, and polishing an amalgam restoration will require alternate forms to prevent examinees from specializing in the particular teeth or areas of the mouth specified for the tests. The development of alternate forms of these tests would be a brief, simple, and straightforward task, involving only minor modifications.

Two other performance tests present more extensive problems in the development of alternate forms. These are the tests in oral hygiene instruction and charting from dictation. In each case, the development of an alternate form would require the creation of a new "patient". For the test in oral hygiene instruction, each new form of the test would require new intraoral photos, dental chart, medical and dental history,

and instructions to the patient actor, and possibly some changes in the performance checklist. For the test in charting from dictation, each new form of the test would require a new script for dictation, dictation tape, and set of multiple-choice questions. (However, these questions are easier to develop than most of those on the written tests.) In both cases the amount of work involved would be substanti[illegible].

A performance test in calculus removal. The Proficiency Examination in its present form does not contain a performance test in calculus removal. The examination could be supplemented with the calculus removal portion of the ADHA Clinical Evaluation. It would also be possible to develop a performance test in calculus removal, in which the examinee's technique is observed and recorded on a performance checklist.

Continuing test development. ETS strongly recommends that if the Proficiency Examination becomes the basis for an ongoing credentialing program, new forms of the written tests should be developed periodically. This continuing test development is necessary for two reasons: to prevent examinees from knowing the test questions in advance and to keep the tests current with advances in dental technology. The latter reason applies to the performance tests as well as the written tests. Therefore, ETS recommends that the entire examination be reviewed periodically by a committee of experts in dentistry, dental assisting, and dental hygiene and revised if necessary to keep it technologically up to date.

ADDENDA

Test Site Personnel

Cabrillo College, Aptos, California

James L. Monahan, DDS, coordinator
Joyce Herceg, RDH, observer
Rosemary Baker, RDH, observer
Gerry Hodges, RDH, observer
Cheri Lusk, RDH, observer
Betty Zachary, RDA, operator
Barbara Sexton, RDH, operator

Des Moines Area Community College, Ankeny, Iowa

Sharon Moore, CDA, coordinator and observer
Diane Schroeder, CDA, observer
Leone Young, RDH, observer
Debbie Phannensteil, CDA, observer
Alberta Lee, CDA, observer
David Llewelyn, DDS, operator and observer

Edmonds Community College, Lynwood, Washington

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Sandy Phillips, CDA, observer
Marsie Sherwood, RDH, observer and operator
Robert Lockyer, DDS, observer and operator

Guilford Technical Institute, Jamestown, North Carolina

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Patricia Hedrick, CDA, observer
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Richard A. Flottman, DDS, operator

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Jane D. Carr, RDH, observer
Christine A. Leimone, CDA, observer
Claude E. Padgett, DDS, operator

ETS Project Staff

Many ETS staff members worked in the Dental Auxiliary Examination Project, and it seems appropriate to acknowledge their contributions.

Samuel Bocchieri assisted in the development of the written tests. Susan Carlson assisted in the development of the performance tests. Amiel Sharon, Lee Schroeder, Andre Diaz, Jayme Zito-Wheeler, and Jacqueline Hiller did the administrative work of the project. Toby Friedman participated in the formative stages of the project. Margaret Browne prepared the pilot test data for analysis, Vickie Tompkins, Helen Tu, and Ann Chang were the computer programmers for the analysis of the data from the pretest and pilot test. Marlene Goodison computed the reading difficulty estimates. Diane Ervin-Logan and Debbie Zosh typed the performance checklists and other materials and assisted in the administrative work. June Thomas, Catherine Snyder, and Norma Deck prepared the manuscript of this report.

Pilot Test
5/1/79

Proficiency Examination for

Dental Auxiliaries

Coordinator's Manual

Contents

	Page
Description of the Examination	1
Personnel Required for the Performance Tests	2
Patients for the Performance Tests	3
Instructions for the Examinees	3
Administering the Performance Tests	3
Materials Needed for the Performance Tests	5

Description of the Examination

The Proficiency Examination for Dental Auxiliaries consists of a written multiple-choice test and performance tests in five competency areas:

I. Chairside assisting
II. Laboratory procedures
III. Diagnostic aids
IV. Patient education
V. Dental therapeutics

The specific tasks involved in the performance tests in each competency area are these:

I. Chairside assisting
  - Assisting with restorations
    - Completing tray setups
    - Preparing the unit and chair and positioning the patient
    - Assisting with the preliminary examination of the patient
    - Assisting with the adminstration of a local anesthetic
    - Assisting with the placement and removal of a rubber dam
    - Assisting with cavity preparation
    - Assisting with an amalgam and a composite restoration
  - Surgical scrub and glove

II. Laboratory procedures
  - Study cast

III. Diagnostic aids
  - Taking of vital signs
  - Taking an alginate impression for a study cast
  - Dental radiography
  - Charting from dictation

IV. Patient education
  - Instructing the patient in oral hygiene practices

V. Dental therapeutics
  - Coronal polishing
  - Polishing of an amalgam restoration
  - Placing and removing a periodontal dressing

Four of these tasks will be performed on actual patients: coronal polishing, dental radiography, alginate impression, and taking of vital signs. Manikins will be used for polishing of amalgam restorations and for all tasks in chairside assisting. The periodontal dressing will be placed on a person who does not actually have a gingival wound; this person may be a patient or someone else who may be available. The performance test in patient education will be done with a patient-actor, or "programmed patient" - a person who is not actually a patient but has been trained to respond in a specified way to the examinee. The performance test in chairside assisting will require an operator who has been trained for this examination to follow a specified procedure for the tasks on the test.

All the performance tests (except for the test in charting from dictation) require an observer to record the examinee's performance on a performance checklist. The observer also is responsible for preparing the examining station and, in those tests done with actual patients, for protecting the patient.

Early tryouts of this examination will require two observers for each examinee, to determine where inconsistencies between observers are likely to occur. The two observers should observe independently and mark their checklists separately, without communicating with each other in any way until they have finished marking their checklists.

Personnel Required for the Performance Tests

As the administrator, you will be responsible for recruiting and training the observers, the patient-actor, and the operator. You will also have to arrange for the procedures that involve real patients to be done under supervision of a dentist. (The dentist need not actually observe these operations for each patient but must be available to perform a preliminary examination on each patient and to deal with any emergencies that may arise.)

Observers. The number of observers you will need depends on the number of examinees you intend to test at one time, since each examinee must be observed by two observers. (Testing more than one examinee at a time will make the observers' job easier, allowing them to specialize.) The observers should be experienced dental auxiliaries who are thoroughly familiar with the procedures they will be observing. If possible, each team of two observers should include one instructor and one practitioner. Every observer should be thoroughly familiar with all the performance checklists he/she will be using and should practice using them at least once before observing any actual examinees. In addition, each observer should be given a write-up of the emergency procedures used at your institution.

Operator. The operator for the test in chairside assisting need not be a dentist, but must be a person who is skilled in the use of the handpiece. (A dental student or an expanded-function dental auxiliary might be a good operator for the test.) The operator must be familiar with the procedure for the test and should practice it at least once, preferably with the observers, before serving as operator for any actual examinee.

Patient-actor. The patient-actor for the test in patient education must be trained to play the role of the patient in a way that is realistic and consistent with the specifications contained in the patient's "program." This person need not have any professional knowledge or background in any dental occupation, but must be able to learn the "program" thoroughly and improvise realistically in case the examinee asks a question not covered in the program. If possible, the patient actor should be someone not known to the examinee in real life.

Dentist on site. Each test site must have a dentist present during the performance tests that are to be done on actual patients. The dentist should examine each patient for any contraindications to the procedures to be done. If there are any contraindications to any of the procedures, those procedures should not be done on that patient. The dentist should also be available to deal with any emergencies that may occur during the performance tests that involve actual patients.

The dentist may also serve as one of the observers or as the operator for the test in assisting with restorations, if he/she has been trained as an observer or operator for the test.

Patients for the Performance Tests

The performance tests in taking of vital signs, taking an alginate impression, coronal polishing, and dental radiography require actual patients. You may require each examinee to provide a patient, or you may arrange for your institution to provide patients. It is not necessary to have an examinee do all the above tests on the same patient, although it may be convenient to do so.

The patient for the coronal polishing task must have extrinsic stain but must have all calculus removed before sitting as a patient for the polishing task. The patient for the dental radiography task must be a person for whom an x-ray series is needed for a valid diagnostic purpose.

The task of placing a periodontal dressing does not require an actual patient but does require a person who does not have an actual gingival wound. This person may be a dental patient or any other person who is available, except another examinee.

Instructions for the Examinees

Each examinee should receive a copy of the Advance Instructions to the Examinee at least two days before the examinee takes the tests. In addition, the observers will have On-site Instructions for the Examinee for each task in the performance tests. The examinee should not receive the on-site instructions for any task until 15 minutes before he/she is to begin that task.

Administering the Performance Tests

The performance tests are intended to be administered separately from the written test, with the exception of the performance test in charting from dictation. This test is to be administered along with the written test, as described below.

The order in which the performance tests are given is not important, except that the alginate impression must be made before the study cast.

You may test more than one examinee at a time, if you find it convenient. However, each pair of observers can observe only one examinee at a time. Therefore, if you test two examinees at the same time, you will need four observers, and so on. If you decide to test more than one examinee at a time, you will want to avoid having them work on the same tasks at the same time, since some tasks require special personnel (the operator; the patient-actor). Also, if you test more than one examinee at a time, be sure to station the examinees in the operatories in such a way that they cannot watch each other working. Do not let any examinee watch another examinee taking any of performance tests.

Performance Test in Charting from Dictation

The performance test in charting from dictation is to be administered along with the written test, using the following procedure.

1. Give each examinee two red pencils, two blue pencils, a copy of the charting answer sheet (with the anatomical chart at the top), and a copy of the examinee's instructions for the performance test in charting from dictation.

2. Read the examinee's instructions aloud to the group.

3. Play the dictation tape cassette. Make sure all examinees can hear the tape clearly.

4. Administer the written test. Make sure the examinees do not hand in their charts along with their written test materials.

5. Give each examinee a copy of the test questions for the performance test in charting, which they are to answer on the basis of their completed charts.

6. Collect the answer sheets and test booklets for the performance test in charting.

You will be provided with two copies of the dictation tape cassette and also a copy of the script from which the tape was made.

Materials Needed for the Performance Tests

1. Chairside Assisting

Assisting with Restorations

Assisting cart

Premeasured amalgam capsules
Dappen dish or amalgam well
Squeeze cloth
Calcium hydroxide base material
Composite restorative material: original containers containing only a small amount of base and catalyst
Mixing pads for calcium hydroxide base and composite material
Spatulas for mixing calcium hydroxide base and composite material
Topical anesthetic
Varnish
Alcohol-saturated gauze
Manufacturer's instructions for mixing amalgam
Manufacturer's instructions for mixing composite material
Manufacturer's instructions for mixing calcium hydroxide base
Triturator (amalgamator), set to proper speed for type of amalgam to be used, with proper mixing time posted
Lubricant for rubber dam
Bib and chain

Incomplete tray setup for amalgam restoration

Mat or rack for hand instruments
Saliva ejector
Wedges
Gauze squares
Cotton-tip applicators
Cotton rolls
Cotton pellets: large and small
Articulating paper
Dental floss
Rubber dam, stamped but not punched
Rubber dam napkin

Incomplete tray setup for composite restoration

Mat or rack for hand instruments
Polishing and finishing discs: coarse, medium, and fine
Finishing strips: fine grit
Plastic matrix strips
Wedges
Gauze squares
Cotton-tip applicators
Cotton rolls
Cotton pellets: large and small
Articulating paper
Dental floss

Instruments for completing tray setups

Hand instruments:

Amalgam carrier, double-ended
Amalgam condenser, double-ended
Gingival margin trimmer, double-ended
Cleoid-discoid carver
Wedelstaedt chisel
Hollenback carver
Jacquette scaler, double-ended
Spoon excavator, double-ended
Wax spatula, double-ended
Explorers - two (2) each
Periodontal probe
Small T-burnisher
Mirrors - two (2) each
Plastic instrument (metal)
Composite filling instrument (double-edged, nylon)
Calcium hydroxide placement instrument
Cotton pliers, non-locking
Gold knife or scalpel with #12 blade mounted

Friction-grip burs of the following types:

Round
Inverted cone
Straight plaincut fissure
Tapered plaincut fissure
Straight crosscut fissure
Tapered crosscut fissure
Pear-shaped
Flame-shaped
End-cutting

A composite (12-fluted) finishing bur, a diamond bur, and an abrasive stone, all friction grip and all in the same shape: pear-shaped, flame-shaped, or round
Latch-type burs of the following types: round cutting, inverted cone, and round finishing
Moores' Mandrel, for latch-type contra-angle
Straight mandrel
Latch-type mandrel with screw head
Bur block
Slow-speed straight handpiece
Contra-angle (latch-type)
Bur removal tool
High-speed suction tip
Rubber dam punch
Rubber dam frame, Youngs
Scissors
Rubber dam clamp forceps
Rubber dam clamps for anteriors, bicuspids, and molars - 3 of each
Tofflemire matrix retainer with bands: #1, #2, #13, #14 - 3 of each
Aspirating syringe
Carpules of local anesthetic in their original containers
Needles for syringe

Surgical Scrub and Glove

Liquid soap or soap in sterile package

Towels
Packaged sterile surgical gloves (in full range of sizes)
Fingernail cleaner
Handbrush

II. Laboratory Procedures: Study Cast

Dental stone
Manufacturer's instructions for dental stone
Spatula
Rubber mixing bowl
Scoop for dental stone
4 x 4 tile or glass slab, or wax paper
Vibrator
Lab knife
Model trimmer

III. Diagnostic Aids

Taking of Vital Signs

Stethoscope
Blood pressure cuff
Clock or watch with second hand
Pen or pencil

Taking an Alginate Impression for a Study Cast

Alginate impression material - regular and fast set
Manufacturer's instructions for alginate material
Two bowls and spatulas for mixing alginate material
Scoop
Water measure
Impression trays
Labels or tape for labeling impression trays
Pencil or pen, disinfected with alcohol
Cloth towels
Dental floss
Wax for bite registration
Lab knife (for trimming wax)
Water bath
Utility wax (rope wax, periphery wax)
Wax strips (for extending tray)
Mouthwash
Small ruler or gauge marked in millimeters
Mirror
Saliva ejector
Emesis basin

Dental Radiography

X-ray film: double film packs and single film packs
Bite wing tabs
Bite block film holders
Film mounts for 14-film periapical series, plus bite wings
Lead apron
Headrest covers
Alcohol-saturated gauze
Dental mirror

IV. Patient Education

Hand mirror
Toothbrushes: both hard and soft, of different colors (for ease of identification by observers)
Dental floss
Dental manikin
Pencils
Paper

V. Dental Therapeutics

Coronal Polishing

A slow-speed handpiece that has been properly cleaned, lubricated, and tested
Prophy angle
Several rubber polishing cups
All polishing cups must be properly sterilized.
Two bristle polishing brushes, properly sterilized
Mirror
Explorer
Cotton rolls
Dental floss
Gauze
Vacuum tip
Saliva ejector
Cotton-tip applicators
Dishes for polishing agents
Dish for soaking brush
Polishing agents - coarse, medium, and fine; labeled
Tin oxide
Ring holder for polishing agents
Alcohol
Dental tape
Towel
Towel clips
Spatula (for putting polishing agents into cups)
Waste disposal sack
Disclosing solution
Dish for disclosing solution
Disposable cup

Polishing of an Amalgam Restoration

Finishing burs (latch type):
  Round: #½, #2, #4
  Flame-shaped: #2, #4
  Pear-shaped: #2, #4
Finishing stones (latch type): round, flame-shaped, and pear-shaped
Impregnated rubber points
Mandrel: latch type
Mounted bristle brush, soft, for straight handpiece
Finishing discs: medium and fine
Finishing strips: medium and fine
Mirror
Explorer
Cotton rolls
Saliva ejector
Dental floss
Dental tape
Polishing agents: flour pumice and tin oxide
Cups for polishing agents

Placing and Removing a Periodontal Dressing

Periodontal dressing material (non-eugenol)
Surgical powder
Mirror
Explorer
Probe
Plastic instrument
Curette
Cotton pliers
Mixing pad
Tongue blade
Gauze
Petroleum jelly
Saliva ejector
Color transfer applicators
Pen or pencil, disinfected with alcohol
Cotton rolls

Charting from Dictation

Cassette player
Red and blue pencils - two of each color for each examinee

Proficiency Examination for Dental Auxiliaries

Advance Instructions to the Examinee

Description of the Examination

The Proficiency Examination for Dental Auxiliaries consists of a written multiple-choice test and performance tests in five competency areas:

I. Chairside assisting
II. Laboratory procedures
III. Diagnostic aids
IV. Patient education
V. Dental therapeutics

The specific tasks involved in the performance tests in each competency area are these:

I. Chairside assisting
- Assisting with restorations
  - Completing tray setups
  - Preparing the unit and chair and positioning the patient
  - Assisting with the preliminary examination of the patient
  - Assisting with the administration of a local anesthetic
  - Assisting with the placement and removal of a rubber dam
  - Assisting with cavity preparation
  - Assisting with an amalgam and a composite restoration
- Surgical scrub and glove

II. Laboratory procedures
- Study cast

III. Diagnostic aids
- Taking of vital signs
- Taking an alginate impression for a study cast
- Dental radiography
- Charting from dictation

IV. Patient education
- Instructing the patient in oral hygiene practices

V. Dental therapeutics
- Coronal polishing
- Polishing of an amalgam restoration
- Placing and removing a periodontal dressing

Your performance on each of these tests will be recorded by two observers. One of the observers will direct the procedure in those tests that require it.

The Performance Tests

Chairside Assisting

Assisting with Restorations

Your performance test in assisting with restorations will consist of the following tasks:

- Select instruments to complete partially prepared tray setups
- Prepare the unit and chair and position the patient
- Assist with the preliminary examination of the patient
- Assist with the administration of a local anesthetic
- Assist with the placement and removal of a rubber dam
- Assist with cavity preparation
- Assist with an amalgam restoration and a composite restoration

The procedures that require a patient will be done on a manikin, rather than on an actual patient. Nevertheless, you are to treat the manikin as if it were a live patient and take all precautions that you would take with a live patient. You will receive a copy of the patient's clinical record. Read it carefully before you begin the problem. It will tell you what specific procedures are to be done.

To save time, the operator will not actually complete all of the procedures on the test. Nevertheless, you are to assist with the procedures in the same way that you would with a real patient until the observer tells you to do otherwise.

The operator for this test will work right-handed from a sitting position. All instrument exchanges will take place within a transfer zone outlined by the rubber dam frame. Use the same assisting procedures that you would use in assisting an operator with whom you have never worked before.

The assisting cart will be prepared for you. The tray setups will be partially prepared in advance. You will complete the setups by selecting and placing instruments. (You will receive instructions telling you how to complete the setups.)

The equipment used in the test will include non-locking cotton pliers, an aspirating syringe, a latch-type contra-angle, and a Youngs rubber dam frame.

Manufacturer's instructions will be available for you to use in preparing materials. You will mix the amalgam from premeasured capsules, using a triturator.

The rubber dam will be placed by the following procedure:

1. Assistant punches holes in rubber dam.
2. Operator places rubber dam clamp on anchor tooth.
3. Operator places rubber dam.
4. Assistant places rubber dam napkin.
5. Operator stretches rubber dam over anchor tooth and clamp and over tooth farthest away from anchor tooth.
6. Assistant ligates anchor tooth with floss to hold dam in place.
7. Assistant places rubber dam on frame.
8. Operator passes dam between patient's contacts.
9. Operator places an additional rubber dam clamp.
10. Operator inverts rubber dam.

Surgical Scrub and Glove

This test requires you to perform a surgical scrub and glove.

Laboratory Procedures: Study Cast

For this test you will pour and trim a study cast from an alginate impression, using the following procedure:

1. Pour the cast in dental stone, using a single-pour technique.
2. About three minutes after pouring the cast, perform a "bench trim," using the lab knife to cut away most of the excess material before it hardens.
3. About one hour after pouring the cast, finish the trimming of the cast using the model trimmer.

(Between steps 2 and 3 you will be taking other performance tests.)

Diagnostic Aids

Vital Signs

For this test you will take the patient's pulse, note the patient's respirations, and take the patient's blood pressure, using a stethoscope and blood pressure cuff.

Taking an Alginate Impression for a Study Cast

For this test you will make an alginate impression for a study cast on a live patient. You will take impressions of both upper and lower arches. You will also take a wax bite. You are to assume that the patient has never had an alginate impression taken before.

Dental Radiography

For this test you will expose and mount a full mouth series consisting of 14 periapical films and bite wings. You may use either bisecting of paralleling technique. Bite blocks will be provided, but you may bring another type of film holder and use it instead. You will have 30 minutes to make the exposures.

Charting from Dictation

This performance test in charting from dictation does not require you to use a particular charting system. You may use whatever system you are familiar with. You are not being tested in the use of a particular formal system, but on your effectiveness at recording information about a patient's dental condition and interpreting what you have recorded. The test will be given in two parts:

1. You will receive red and blue pencils to use in charting. You will also receive a sheet containing blank charts of two types: anatomical and schematic. You may use whichever chart you prefer. You will listen to a tape recording of a dentist dictating information to be charted. While you listen to the tape recording, you will record the information on your chart.

2. You will be given a series of questions based on the information contained in the tape recording. Using your chart, you will answer these questions from the information you have recorded on the chart.

You will be taking other tests in between parts 1 and 2 of this test. Make sure to keep your chart until you have completed part 2 of this test.

Patient Education

This test is a test of your ability to conduct a patient education session that will improve the patient's oral hygiene practices. The patient's dental chart and history form will be provided. Your task is to identify the patient's dental problems that can be helped by home care and to instruct the patient in the necessary oral hygiene procedures. It will be up to you to decide what to teach the patient and how to teach it. Pencils, paper, toothbrushes, dental floss, a hand mirror, and a dental manikin will be provided. You will have 20 minutes for this test.

Dental Therapeutics

Coronal Polishing

This test will be done on a live patient. Any calculus will have been removed prior to the test. You will polish the patient's teeth and remove any extrinsic stain. You will be evaluated on the polishing of two quadrants. The observer will tell you which two quadrants to polish for evaluation. You will not be permitted to use a disclosing agent. You will have 20 minutes to complete the polishing.

Polishing an Amalgam Restoration

For this test you will polish an amalgam restoration in a manikin. You will have 10 minutes to polish the restoration.

Placing and Removing a Periodontal Dressing

This test will be given in two parts. In the first part you will place a periodontal dressing and instruct the patient in postoperative care. In the second part you will remove the dressing and instruct the patient in postoperative care. The two parts will be separated by 30 minutes or more, during which time you will be taking other performance tests. You will have 15 minutes to mix, place, and trim the dressing and 5 minutes to remove it.

Proficiency Examination for Dental Auxiliaries

General Instructions for Performance Test Observers

Description of the examination

The Proficiency Examination for Dental Auxiliaries consists of written tests and performance tests in five general areas of dental auxiliary work: chairside assisting, laboratory procedures, diagnostic aids, patient education, and dental therapeutics. The purpose of the performance tests is to test what the written tests cannot adequately test: the examinee's skills and procedures in actually performing a selection of important tasks.

The specific tasks involved in the performance tests in each competency area are these:

I. Chairside assisting
- Assisting with restorations
  - Completing tray setups
  - Preparing the unit and chair and positioning the patient
  - Assisting with the preliminary examination of the patient
  - Assisting with the administration of a local anesthetic
  - Assisting with the placement and removal of a rubber dam
  - Assisting with cavity preparation
  - Assisting with an amalgam and a composite restoration
- Surgical scrub and glove

II. Laboratory procedures
- Study cast

III. Diagnostic aids
- Taking of vital signs
- Taking an alginate impression for a study cast
- Dental radiography
- Charting from dictation

IV. Patient education
- Instructing the patient in oral hygiene practices

V. Dental therapeutics
- Coronal polishing
- Polishing of an amalgam restoration
- Placing and removing a periodontal dressing

Four of these tasks will be performed on actual patients: coronal polishing, dental radiography, alginate impression, and taking of vital signs. Manikins will be used for polishing of amalgam restorations and for all tasks in chairside assisting. The periodontal dressing will be placed on a person who does not actually have a gingival wound; this person may be a patient or someone else who may be available. The performance test in patient education will be done with a patient-actor, or "programmed patient" - a person who is not actually a patient but has been trained to respond in a specified way to the examinee. The performance test in chairside assisting will require an operator who has been trained for this examination to follow a specified procedure for the tasks on the test.

The performance tests have been constructed to test both the procedure the examinee uses and the results the examinee obtains. Although results are what matters on the job, there are important reasons for testing the examinee's procedures as well. The examinee may be using a procedure that involves a risk of harm to the patient, or one that is wasteful and inefficient, or one that will not produce consistently good results.

Administering the performance tests

Fairness requires that all examinees take the test under conditions that are as nearly the same as possible. As the observer, you will be responsible for preparing the equipment and materials for each examinee. You will receive printed observer's instructions for each test, including instructions for preparing the equipment. Please follow the instructions closely. If the instructions are not clear on some points, decide what to do on the basis of your own knowledge of dental auxiliary practice and instruction.

For each task on the performance tests, the observers will have a set of On-site instructions to the examinee. Give these instructions to the examinee just before he/she begins the task and collect them as soon as the examinee has finished the task. Do not let the examinee keep the on-site instructions for any of the tasks.

Observing the examinee's performance

Your main job as an observer is to observe and record the examinee's actions in performing each task. To help you do this job you will have a performance checklist, which lists a number of specific things the examinee should do. As you watch the examinee, you will check spaces on the checklist marked "yes" or "no" to indicate whether the examinee did or did not do each specific thing. (In some cases you will also be asked to record other types of specific information on the checklist.) In general, the examinee is not required to do the things on the checklist in the order in which they appear on the checklist. When it is important that the examinee do one thing before doing another, the checklist will say so. However, the examinee is expected actually to perform all actions specified on the checklist. If the examinee begins to tell you what he/she would do instead of actually doing it, tell the examinee to do the things he/she is describing.

To do your job effectively you will need to be thoroughly familiar with each performance checklist you will be using, so that you will know what to watch for and where to record what you have observed. The best way to become familiar with a performance checklist is to read it carefully and then practice using it, by having someone actually do the task while you observe and record his/her performance. You should also be familiar with the instructions to the examinee and with any other printed materials used in the test.

You should do your best to avoid giving the examinee any "feedback" on his/her performance during the test. Try not to indicate - by word, gesture, or facial expression - whether the examinee is doing things right or wrong. (Exception: in certain cases you may have to stop the examinee, to prevent a risk of harm to the patient.)

For some administrations of this test there will be two observers watching at the same time. In these cases it is important that the two observers complete their checklists independently. If you are working with another observer, do not look at the other observer's checklist until you have completed yours. Do not exchange information or opinions with the other observer until you have finished marking your checklist. Once you have finished marking your checklist and have looked at the other observer's checklist or discussed the examinee's performance, do not change any marks you have made.

For some experimental administrations of these tests you will also be asked to make a judgment of the examinee's performance of each task as being adequate or inadequate. These judgments are not part of the test, but will be used to provide interpretive data to test users. Remember that you are not being asked to apply the highest professional standards of proficiency - only to judge whether the examinee's performance would be adequate in a dental office or clinic.

Several of the performance tests contain checkpoints stating, "Examinee uses aseptic technique . . ." These checkpoints refer to the prevention of cross-contamination. However, if cross-contamination occurs because the examinee has neglected to disinfect a surface and this omission has already been noted on the checklist, do not count the same error against the examinee in evaluating aseptic technique.

Protection of the patient

As an observer, you are responsible for protection of the patient during those tasks to be done on actual patients. The observer's instructions include procedures for safeguarding the patient. Some of these procedures are also printed on the performance checklists as a reminder to you. Do not let the examinee use any procedure that endangers the patient. If the examinee starts to do something that endangers the patient, stop the examinee, correct the error, mark your checklist, and then tell the examinee to proceed.

Performance Test in Assisting with Restorations

Instructions to the Operator

You will be serving as the operator in a clinical performance test in chairside assisting. The "patient" for this test will be a manikin. However, the examinee is to treat the manikin as if it were a real patient and to observe all precautions that would be appropriate with a live patient. You should do the same, except for the actual placement of restorations (as explained below.) The examinee's tasks will include assisting with cavity preparations.

These preparations may be partly completed in advance, to save testing time. They may be preparations that were completed and partially restored during the testing of a previous examinee, as long as they contain enough excess material to test the examinee's ability to use suction to remove debris from the work area.

Part of this test involves assisting with an amalgam restoration and a composite restoration. Since the purpose of the exercise is to test the assistant's skills, it is not necessary to finish these restorations. To save time, the operator should place only one increment of amalgam and should not wait for the composite material to cure.

Part of this test involves assisting with the placement and removal of a rubber dam. It may be necessary to lubricate the patient's teeth in order to place the dam. If the dam tears, disregard the tear and proceed, unless the tear is large enough to interfere with the cavity preparation or restoration process.

Procedures

In a test of this type, it is important that all operators follow the same sequence of operations. The operator will work right-handed, from a sitting position. Bur changes will be made by the assistant, who will retrieve the handpiece, change burs, and deliver the handpiece.

Ideally, the operator should maintain fulcrums on the "patient" during the transfer of instruments. However, some operators may find this procedure difficult. In any case, all instrument exchanges for this test must be made within a transfer zone outlined by the rubber dam frame.

Assisting with Restorations
Operator

The assistant's performance in this test will be recorded by observers using a performance checklist. The observers will check the examinee's performance of each instrument exchange and preparation and delivery of materials. Each time instruments are exchanged, the observers must observe the exchange, then mark their checklists. The procedure has been standardized, so that all assistants taking this test will be tested on the same sequence of instrument exchanges. For these reasons, the entire procedure will be directed by one of the observers, who will tell the examine which instruments to deliver to you.

Some types of errors by the assistant are difficult for anyone but the operator to detect. Part of your job is to make these errors observable:

1. If the assistant delivers the wrong instrument, say "No, this is a _____; I need a _____." (The same applies to burs, finishing discs, etc.)

2. If the assistant delivers the instrument to you in an incorrect or awkward position, look at the observers to make sure they are watching and shift the instrument to the correct position. The same applies to the syringe, the handpiece, etc. If you need to turn the barrel or the needle on the syringe, make sure that the observers can see you do it.

Each time the examinee delivers an instrument to you, simulate working with it while the observers are marking their checklists. Continue to simulate working with the instrument until the observer's next command to the examinee. Because the observers will be directing the procedure, you do not need to remember the exact sequence of instrument transfers. You need only check to see that the examinee delivered the instrument or material specified by the observer.

You should avoid giving the examinee any additional information not given by the observer directing the procedure. (For example, do not tell the examinee what size holes to punch in the rubber dam.)

Before you enter the operatory, the examinee will prepare tray setups, prepare the unit and chair, and seat the "patient".

Assisting with Restorations
Operator

Rubber dam procedure

The procedure for placing the rubber dam will be as follows:

1. Assistant punches holes in dam.
2. Operator places clamp on tooth.
3. Operator places rubber dam.
4. Assistant places rubber dam napkin.
5. Operator stretches dam over clamp and over tooth.
6. Assistant ligates tooth with floss.
7. Assistant places rubber dam on frame.
8. Operator passes dam between patient's contacts.
9. Operator inverts rubber dam.

It may be necessary to lubricate the manikin's teeth for installation of the rubber dam. If the rubber dam tears, the operator should continue with the procedure unless the tear is so large as to interfere.

The procedure for removing the rubber dam will be as follows:

1. Operator removes rubber dam clamp.
2. Operator cuts rubber dam with scissors.
3. Operator removes rubber dam and frame.
4. Operator checks rubber dam for missing fragments.
5. Operator examines patient with mirror and explorer.